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FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

Official Organ of the Royal Aero Club First Aeronautical Weekly in the World Founded 1909

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Getting Things Untaped

AS an air-faring nation with a future that will be largely identified with her place in aeronautics, Great Britain must maintain Soviet achievements under constant scrutiny. We have been saying as much ever since the Tu-104 first came to London (when half-baked comment and criticism cast scant credit upon supposedly informed observers). The Tu-104 was a mere first thrust into the turbine-transport business: and we—as do the Russians themselves—mean *business*. That this is increasingly recognized by our leaders is a good sign. It was B.E.A.'s chairman who said the other day that Aeroflot would extend across the Atlantic and across the world. They have some very good aeroplanes, he said, including one, the Tu-114, that provides an answer to mass travel at cheap fares and will make an impact on civil air transport. And when Lord Douglas says "good aeroplanes" he means that they are good in a business sense. True, as Mr. Peter Masefield remarked on the same occasion, the Russians are still commercially naïve. But he was right in believing that they will learn very quickly.

We have more than once expressed regret that fuller information has not been forthcoming on the new family of Russian transports. But we entirely believe the explanation that an Embassy official gave us a little while back: "Just b—— red tape," he said explosively. The red tape, of course, was the jumble caused by that same commercial naïvety.

In a few days' time J. M. Ramsden of our "Air Commerce" staff will be flying B.E.A. to Moscow with a brand-new notebook and an open mind. We shall be surprised if all he brings back is a few strands of sanguinary tape entwined around his neck.

Manned Missile

WE present this week the most comprehensive account of the North American X-15 yet published; and we are especially glad to accord it such treatment, for it is designed neither to act as a deterrent nor as a vehicle for any weapon system. Its purpose is the oft-forgotten one of increasing man's knowledge of his environment. (We are not so innocent as to imagine that the X-15 programme will not prove of inestimable value to American military men; but that is incidental.)

Since the pioneer Bell XS-1 appeared in the year following the war the world has come to regard the tribe of American high-speed research machines with undue familiarity. One more on the list is unlikely to make headlines in a world encircled by Sputniks. But it is worth considering the implications of this new aeroplane. First, it is little short of incredible that the airframe skin has been made in Inconel X; for not many years have elapsed since a biscuit tin could not have been accurately fabricated in this material. The difficulties of guiding such a vehicle during its soundless ballistic trajectory at a mile a second can be appreciated only by those who have struggled to develop control systems for 600 m.p.h. aeroplanes that fly within the atmosphere. The human problems are fantastic, and even today nobody knows for certain how the X-15's pilots will fare. Even in the fields of propulsion and accessory power the X-15 breaks wholly new ground.

Trivial malfunctions have marred the X-15's first captive flights, but the way now seems clear for this black dart to be launched to fly on its own. During the coming months the data will be piling up; and the value should far exceed the $121m which America has invested.

FROM ALL QUARTERS

LORD BRABAZON with a model, presented by R.Ae.C. members, of the Voisin biplane on which he made the flight celebrated last week (see "Tribute to Britain's No. 1 Pilot")

D.H. Chairman Retires

IT was announced last week that Mr. W. E. Nixon is to retire on June 30 from the chairmanship and managing directorship of de Havilland Holdings Ltd., his chairmanship of three companies in the organization, and his directorship of five others. Mr. Nixon, who was one of the founders of the de Havilland Aircraft Co. Ltd. in 1920, is to be succeeded in the various posts by Sir Aubrey Burke, who is at present deputy chairman of de Havilland Holdings and holds a number of other Board appointments. Details of Mr. Nixon's and Sir Aubrey's careers appear on page 654.

Sir David Atcherley Joins Folland

IT was announced last week that Air Chief Marshal Sir David Atcherley, who recently retired as C-in-C. Flying Training Command, has joined the Board of Folland Aircraft Ltd. as sales director. The company states that Sir David will "control all aspects of sales promotion, including dealings with overseas agents and maintenance of close liaison with actual and potential users."

Tribute to Britain's No. 1 Pilot

TOO often occasions described as "historic" fail to merit that adjective; but there could be no question of its aptness in relation to the dinner held at the Royal Aero Club, Piccadilly, on April 30 "to celebrate the 50th anniversary of the first aeroplane flight in this country by The Right Honourable Lord Brabazon of Tara, P.C., G.B.E., M.C."

Almost a hundred members, leaders in aviation through the years, filled to capacity the club dining room—a room which the guest of honour said he recalled with pleasure from as long ago as his eighteenth year, when it had been part of the Automobile Club.

The toast to Lord Brabazon was proposed by Mr. Alan Lennox-Boyd, Secretary of State for the Colonies (who had, it seemed, undertaken to do so some 18 years ago, when "Brab" was Minister of Transport—on condition that they both survived to celebrate this anniversary). In a brilliantly witty and erudite speech Mr. Lennox-Boyd spoke of Lord Brabazon as "an Elizabethan figure" who could have met as an equal any of the heroes of the first Elizabethan age: he could have shown them how to drive racing cars, to fly balloons and aeroplanes and to sail a boat; how to beat the immortals of the Cresta Run and how to play themselves in as captains of the Royal and Ancient; how to carry on four simultaneous games of chess by correspondence; how to fight wars; how to run the Ministry of Aircraft Production, the Air Registration Board, the Royal Institution, the Royal Aero Club, the Royal Aeronautical Society; how to be a scientist, an engineer, an industrialist; how to write a very good book . . .

With these and many more such references, pointed by appropriate anecdotes, Mr. Lennox-Boyd sketched his subject's character. He concluded with a 300-year-old quotation from Burton's *Anatomy of Melancholy*: "If the heavens then be penetrable . . . it were not amiss to make wings and fly up; and some new-fangled wits, methinks, should some time or other find out." "Tonight," said Mr. Lennox-Boyd, "we meet to honour the best-loved of all new-fangled wits, who during the week-end April 29-May 2 (the official date is May 2) 50 years ago made the first flight by an Englishman in this country. He brought great honour to Britain in that week-end, and he has continued to do so ever since."

In his response, Lord Brabazon recalled aviation's pioneering days up to the death of the Hon. C. S. Rolls in 1910, mentioning in particular Claude Grahame-White (who was present at the dinner) —"there has never been a more distinguished aviator: he was the bravest of the brave and readily flew the most outrageous aeroplanes." Grahame-White was flying in France while "Brab" was getting his certificate in England—"but Claude got his French certificate first."

Of his own flying in France, Lord Brabazon recollected a windy day in November, 1908, when a gust suddenly lifted him to 14ft ("you must remember that most of our flying was done on the ground"). Of such an occurrence he had no previous experience—or, of course, any instruction in dealing with it—and the Voisin biplane dropped a wing; but luckily no damage was done.

On another occasion—this time in the Isle of Sheppey, and actually on the flight being celebrated that evening—he had been less fortunate: a wing dropped, and "I remember recovering among wires and struts to find my Irish terriers, who had chased the aeroplane, washing my face."

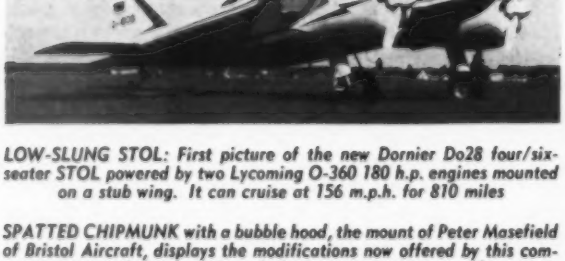
In a brief but happily phrased speech Mr. Grahame-White wished the guest of honour future health and happiness.

Chipmunk Tourer

THE touring version of the D.H. Chipmunk exhibited recently on several light-aircraft occasions by Mr. Peter Masefield is to form the prototype of a standard conversion to be offered by Bristol Aircraft Ltd. As shown in the accompanying photograph, it incorporates a bubble canopy and faired wheels. Other features include baggage compartments in the wing centre-sections, glass-fibre spinner, glass-fibre nose cowl, combined anti-collision light and rear-view mirror, long-range fuel tanks, and a navigation locker in the front cockpit. Fluorescent anti-collision paint can also be included in the conversion.

The modifications have been devised in agreement with de Havilland and in conjunction with the A.R.B. Improved performance and accommodation, increased range and enhanced maintenance characteristics have been the main objectives. The glass-fibre spats are reported to add about 5 kt to the cruising speed and have the added advantage of protecting the undersurfaces of wings and flaps from mud and corrosion. Advantages claimed for the spinner and nose cowl include a substantial saving in weight and unlimited fatigue life.

The anti-collision light, mounted on top of the windscreen, is a Grimes rotating beacon. A long-range tank modification, now awaiting clearance, will increase total capacity to a maximum of 64 gal. The wing baggage compartments measure 24in × 18in × 8in. A further possible modification is the installation of ADF.



LOW-SLUNG STOL: First picture of the new Dornier Do28 four/six-seater STOL powered by two Lycoming O-360 180 h.p. engines mounted on a stub wing. It can cruise at 156 m.p.h. for 810 miles

SPATTED CHIPMUNK with a bubble hood, the mount of Peter Masefield of Bristol Aircraft, displays the modifications now offered by this company as a touring conversion of the type (news-item on this page). The Grimes anti-collision beacon is prominent

"Flight" next week: HELICOPTERS OF THE WORLD

Gloster Board Appointments

FOLLOWING recent reorganization of Hawker Siddeley Aviation, and of the partner firms of Armstrong Whitworth, Hawker and A. V. Roe, it is now announced that major reconstitution of the Board of Gloster Aircraft has taken place. The following appointments have been made: Messrs. Hugh Burroughes, F.R.Ae.S., chairman; E. W. Shambrook, F.C.I.S., general manager; H. W. Sidwell, O.B.E., A.F.R.Ae.S., works director; J. A. R. Kay, F.R.Ae.S., director; J. T. Lidbury, J.P., director; and S. D. Davies, B.Sc.(Eng.), F.R.Ae.S., director.

Export Prospects

BRITISH aircraft exports during the first quarter of this year amounted to more than £41m. This was a record for any three-monthly period, exceeding last year's January-March figure by 17 per cent; it represents a daily value of almost half a million sterling and an annual total of £164m, compared with the 1958 record of £154m.

The figure for March (£15,474,159) was the second largest monthly total ever achieved. Aircraft and parts accounted for £10,364,532 (the third highest ever), engines for £4,429,151 (the fifth largest monthly total), electrical equipment for £412,303, instruments for £206,098 and tyres for £62,075. Argentina was the chief buyer of aircraft and parts during March, spending £2,680,568 (D.H. Comet deliveries accounting for the major part); next were India (£1,594,945) and Israel (£1,142,330).

Commenting on these record figures the S.B.A.C. director, Mr. Edward Bowyer, said that today's exports were the harvest of research and development done ten years ago; the need for continued Government help in those fields was of paramount importance. He added that we must expect a drop in exports. "The industry's record first quarter has not caused me to alter this view; indeed, I shall be surprised and happy if this year's total is as high as the 1958 record."

Vickers Assistant Chief Designers

APPOINTMENT of two new assistant chief designers has been announced by Vickers - Armstrongs (Aircraft) Ltd. They are Mr. A. N. Clifton, M.B.E., B.Sc., F.R.Ae.S., and Mr. Maurice J. Brennan, B.Sc., M.I.Mech.E., F.R.Ae.S. Mr. Clifton was formerly chief designer (aircraft) at the Supermarine Works, and he now moves to Weybridge in accordance with the company's policy of centralizing design work. Mr. Brennan is well known as former chief designer at Saunders-Roe Ltd.

Mr. Clifton

Mr. Brennan

Super Trader Found

REMARKABLE skill and endurance by an R.A.F. mountain rescue team from Cyprus, whole-hearted co-operation from the Turkish authorities and continuous air-to-ground support, led to the recovery last weekend of bodies and equipment from the missing Super Trader (Tudor 4B) G-AGRH of Air Charter Ltd. Wreckage of the aircraft, which had been missing since April 23 on a flight from Ankara to Bahrain, was sighted by an R.A.F. Hastings near the summit of Suphan Dag (14,547ft) in Eastern Turkey.

In its rescue work the R.A.F. team was supported by Turkish helicopters, which brought up food supplies, and by R.A.F. aircraft which maintained radio contact with the ground party. Both the extreme cold, and marauding wolves and bears, proved hazards; and the supporting aircraft dropped blankets and firearms.

The bodies of the 12 men on board the Tudor were buried in a common grave; the aircraft's instruments were sent down to Ankara to aid investigations into the accident; and M.o.S. equipment destined for Woomera was being destroyed.

LITTLE NEEDLE-NOSE: After conversion by SFERMA at Bordeaux, the Max Holste MH.152 prototype, predecessor of the Broussard, has flown with a Turboméca Astazou turboprop which now gives over 400 h.p. Jacques Lecarme was pilot and M. Szydlowski, the engine designer, acted as engineer. MH.153 is the new type designation. The diminutive engine is also being fitted to a Nord 1100 at Bordeaux

THUM'S DOWN as Mr. E. A. Richards of Short Brothers & Harland Ltd. hands over his report of the last "Thum" weather-reporting flight from Woodvale (see news-item on this page) to Dr. J. M. Stagg, Director of Services, Meteorological Office. Also in the group, from left to right, are Mr. J. Formby (who shared the flying with Mr. Richards); G/C. H. R. Edge, S.O.A. No. 12 Group, Fighter Command; and Mr. F. A. Chapman, Short Brothers' flight commander at Woodvale

Exit Thum

AFTER nearly 3,000 sorties carried out during the past eight years, the daily meteorological flights from R.A.F. Woodvale, Lancs—"Operation Thum"—came to an end last Friday. The Thum Flight, operated by Short Brothers and Harland Ltd. under contract to Air Ministry, previously used Spitfires but has latterly employed Mosquito TT.35s. A regular routine was followed by the pilots, Mr. John Formby (an ex-R.A.F. flight lieutenant) and Mr. Eric Richards. They climbed to a point north of Worcester, making notes of temperature, visibility, cloud and turbulence at various altitudes; and having thus obtained a description of weather conditions over the centre of Britain the pilot landed at Speke Airport. The information was then handed in to the met. office for transmission to the Central Forecasting Office at Dunstable, whence it was sent all over Europe.

IN BRIEF

Ekco Electronics Ltd. are to supply Type E160 search radar, with Doppler drift-measuring equipment, for Kuwait Airways' Viscount fleet. This order, secured in the face of intense U.S. competition, follows others (from the Lebanon and Iraq) for similar equipment.

* * *

Re-engineering of the Decca Navigator Mk 10 receiver to Arinc standards has now been completed, and the new set is known as the Mk 10A (Type 900). It is of 1½ ATR size, weighs 42 lb and can be hinged open while operating for ease of maintenance. Either 115 V A.C. or 28 V D.C. supplies may be used.

* * *

Mr. N. E. Rowe, technical director of Blackburn and General Aircraft, has accepted an invitation to succeed Mr. Eric Mensforth as president of the Helicopter Association. Other news from the Association is that the 1958 Cierva Essay Competition has been won by Mr. E. R. Kendall, a project aerodynamicist with Saunders-Roe Ltd. (two other entries, a joint paper by Messrs. B. S. Shenstone and R. H. Whitby, and a paper by Mr. C. H. Naylor, were highly commended); and that the fourth helicopter garden party will be held at Dunsborough Park, Ripley, on June 6.

* * *

In connection with Photofair (Olympia, London, May 11-16) two special numbers of *Amateur Photographer* are being published—a show guide, dated May 6 and now on sale, and a report number next Wednesday, May 13.

Escape mechanism of Project Mercury manned satellite is tested at NASA pilotless aircraft research station, Wallops Island, Virginia. The escape rockets lifted the one-ton full-scale "boilerplate" capsule model to 2,250ft, when the capsule and tripod were separated and the former descended by parachute, recovery from the sea being by helicopter

Missiles and Spaceflight

BRITISH SPACE PHILOSOPHY

Following seven questions in the House of Commons on April 27, further discussion in both Houses on April 29 and a Cabinet meeting on April 30, a Government decision on whether Britain should embark upon her own space research programme was expected within one or two weeks as this issue went to press.

Answering the Parliamentary questions of April 27, the Minister of Supply, Mr. Aubrey Jones, said that a statement of policy would shortly be made. Newspaper reports of May 1 unofficially stated that the Cabinet had decided on a five-year programme costing between £10 million and £20 million, and that co-operation between the U.S.A. and this country in providing equipment and publishing results would form a basic principle. As for the detailed arangements, reports were conflicting, it being variously stated that Blue Streak would be used with American satellites and British instrumentation; and that a U.S. launching vehicle would be used to fire into orbit a British satellite.

ARPA SATELLITE PROJECTS

Three types of communication satellites are to be developed by U.S. companies for the spaceflight programme of the Advanced Research Projects Agency of the Department of Defense. The first of these, for which industry bids are imminent, is known as Project Courier and will be a delayed relay satellite operating in a similar manner to the Project Score satellite launched last December. The Courier satellite will weigh 500 lb and will carry 20 teletype messages between two or more earth stations.

The remaining two communications satellites will be a hovering real-time repeater, weighing 600 lb and remaining in a "stationary" equatorial orbit at a height of 22,400 miles; and a Polar real-time repeater weighing 450 lb which, orbiting at a lower altitude, would fill in the high-latitude gap in the coverage of the stationary equatorial satellites. The equatorial orbit satellites will be able to re-broadcast instantaneously and continuously radio/teletype messages between earth stations, with a capacity of 144 voice channels or several thousand teletype channels.

BLUE STREAK PROPULSION

The photograph below is the first to be released showing a large liquid-propellant rocket engine built by Rolls-Royce, Ltd. Incorporating design principles evolved by Rocketdyne division of North American Aviation, with whom Rolls-Royce have a licence-agreement, the Blue Streak engine is essentially similar to the Rocketdyne MB-2 and S-3 engines. It differs chiefly in having an entirely rearranged turbopump group and control system, and the chamber—although pure Rocketdyne in construction—has a markedly different profile. The American chambers have a nozzle whose divergence decreases to zero at the final exit, whereas the Rolls-Royce unit maintains its divergence unaltered. This may indicate that the engine is designed to give optimum performance at an expansion ratio appropriate to flight above the atmosphere—which may suggest a long burning time.

This photograph is the first to show a Rolls-Royce rocket engine similar to that fitted to the D.H. Propellers Blue Streak long-range ballistic missile. It is discussed in the paragraph above

The first test firing of a Rolls-Royce engine took place in May last year at the M.o.S. establishment at Westcott. Shortly the full static-test programme of the final flight version will begin at Spadeadam, which is managed by Rolls-Royce on M.o.S. behalf. Over 250 men from the contractor's factories at Derby, Barnoldswick and Glasgow are already working at the new Cumberland site. It has been stated that during its first runs at Westcott the British engine "fully realised its design performance."

BULLPUP OPERATIONAL

Late last month the carrier U.S.S. *Lexington* sailed for duty with the 7th Fleet in the Pacific. Part of her complement is the Attack Squadron 212, equipped with North American FJ-4B Furies, each of which can carry five Bullpup air-to-surface missiles. Bullpup, made by Martin's Orlando plant, weighs 540 lb and has command guidance for hitting heavily defended point targets.

BOMARC STATION STRENGTHS

It can now be revealed that each U.S.A.F. Bomarc IM-99 area-defence missile base will be equipped with from 30 to 60 of the large Boeing-built missiles. The first such establishments—Suffolk County A.F.B., N.Y., and McGuire A.F.B., N.J.—will each have 60 Bomarcs and fewer than 300 men. Twelve other bases currently authorized will be armed with 30 rounds apiece.

CONTRACT FOR SCOUT

Chance-Vought Aircraft Inc. are to build the airframe of the four-stage, solid-propellant Project Scout rocket vehicle and will "integrate" the four rocket stages. A $945,000 contract was awarded to the company by the National Aeronautics and Space Administration last month.

Scout is designed to boost a 150 lb satellite into a 300-mile orbit around the earth, or a 100 lb instrument payload to 5,000 miles or more in high-altitude tests. Each vehicle will cost about $500,000—substantially less than other comparable rockets. The four stages will be (1) modified version of an early Polaris motor by Aerojet-General; (2) improved Sergeant by Thiokol; (3) scaled-up Vanguard third stage by Allegany Ballistics Laboratory; and (4) a motor similar to the present Vanguard third stage, also by A.B.L. Initial tests are scheduled for mid-1960 at Wallops Island.

THE FAR EAST AIR FORCE

Varied and Valuable Peace-Time Tasks

By NORMAN MACMILLAN

FAR EAST AIR FORCE HEADQUARTERS are about 18½ flying hours by Comet 2 from Lyneham airfield. The elapsed time depends on the mode of flight, whether by double aircrews, slip crews along the route, or one crew night-stopping. There is a sun-time loss of 7½ hr when flying east, an equal gain when flying west. Reckoning solar time at each terminal, the fastest eastward journey takes about 30 hr, the fastest westward about 15 to 16. V-bombers with their longer range and faster cruise can clip some hours off these times. The Hastings, good old workhorse though it be, takes twice as long; that is why it is to be replaced on the longer routes of R.A.F. Transport Command. Moreover, the greater noise-level of its piston engines is far more fatiguing, an important factor on a route between two strategic reserve centres.

H.Q. F.E.A.F. is at Changi, at the eastern end of Singapore Island. It combines the Command headquarters and the tactical H.Q. controlling the three air bases on the island, since Air Headquarters Singapore was abolished in accordance with the recommendations of the Hollinghurst report for economies in the R.A.F.

The headquarters are delightfully situated on a slight eminence overlooking the eastern channel leading to the Johore Strait and the estuary of the Johore River. The grounds are pleasantly laid out with tropical trees—the red-blossomed flame of the forest, the yellow-flowering cassia, the handsomely tall, laurel-like-leaved garcinia, the drooping and less brilliantly yellow-blossomed casuarina, banana and papaya trees; and for shrubs the purple bougainvillea, delicate oleander, jasmine and deep-scented frangipani. The air is hot and the atmosphere sticky with the humidity of a rainy, low-level tropical island. Diurnal temperature varies from about 93 to 78; perhaps one feels the absence of cool nights more than the higher day temperature, which is low relative to parts of India, Pakistan, Iraq or even Cyprus in the summer. Singapore has much the same climate and temperatures all the year round, so that there is no let-up unless one can go up to the two hill stations in Malaya or on leave to Hong Kong, where there is a recognizable summer and winter solstice. The tour at Singapore and Malaya is 2½ years and most of the R.A.F. personnel posted there find that enough, though some love it and would willingly stay longer.

Within the headquarters building the air is cooler because the fans are turning in every room and the windows are all wide open. The local pigeons (like those in Trafalgar Square) would roost and nest on the window ledges if allowed. Outside the windows brilliant birds flit from tree to tree—the black-naped oriole with bright yellow plumage, the magpie robin who sings like our home thrush, the Javanese myna whose song is like our blackbird's but with a descending trill at the end, and many others. F.E.A.F. has the most attractively situated R.A.F. Command headquarters I have ever seen, but not the most attractive building.

Singapore and Malaya lie below the atmospheric intertropical convergence zone. While I was there they appeared to have a fairly regular weather sequence, although its timing was always uncertain: a clear morning with sunshine, clouds beginning to build up about eleven, perhaps thunder and rain then, or a continuance of the build-up until the afternoon; then at about four or five there would come a deluge, followed by an evening of thunder muttering in the distance or perhaps a final rainstorm before the night became fine and clear. That is the sequence when one is stationary. When flying through this weather there is often more bad than good. The height of the cloud upper level may be 45,000 or 50,000ft. I have flown through cirrus stratus at 42,000ft and seen the cupola-shaped tops of cumulo-nimbus rising some 5,000ft higher on one side and the rarer anvil cloud yet higher on the other. Aircraft flying in these conditions require and ought to carry search radar, whose green blips display the presence of cu-nim and of island groups, thus providing simultaneously an aid for navigation and against collision.

The officers' mess at Fairy Point is the best appointed R.A.F. mess I have ever visited. It is spacious, comfortable, beautifully situated and admirably run. The food is excellent, with a mixture of English, Chinese and Malay dishes which provides the variety so necessary in a relaxing climate. Every Sunday evening after dinner a newsreel and feature film are shown in the grounds, with seats set out on the lawn. Dress on that occasion is a white dinner jacket, black tie and black trousers; ladies wear evening gowns. On ordinary evenings officers wear white shirt, long tie and lounge trousers. Working dress is open-neck khaki shirt with No. 6 khaki drill uniform; the jacket may be slipped off for greater comfort in the heat. The one discomfort I found was the ceaselessly twirling reflection of the rotating fans in the polish of the dining tables.

Canberra B.2s of No. 45 Sqn. fly past Singapore's waterfront

A.V-M. A. A. Adams, C.B., D.F.C., the Chief of Staff, described F.E.A.F. to me as "a big parish but an interesting one." Its composition as a Commonwealth Air Force makes it doubly interesting, for its staff and operational units alike are drawn from the R.A.F., R.A.A.F. and R.N.Z.A.F. Of course Britain, Australia and New Zealand are all members of SEATO and F.E.A.F. is part of the SEATO defence. But I believe the principle of the Commonwealth Air Force is intrinsically sound and might profitably be extended to other areas.

F.E.A.F. differs from the R.A.F. home commands (which are functional) by being fully built up as a complete air force—able, if necessary, to operate in isolation for extended periods. It is thus more like a modern version of the Air Force of the First World War, able to undertake whatever task is necessary. It does not, however, possess its own V-bombers; these are retained within Bomber Command but are able (if required) to operate from F.E.A.F. bases.

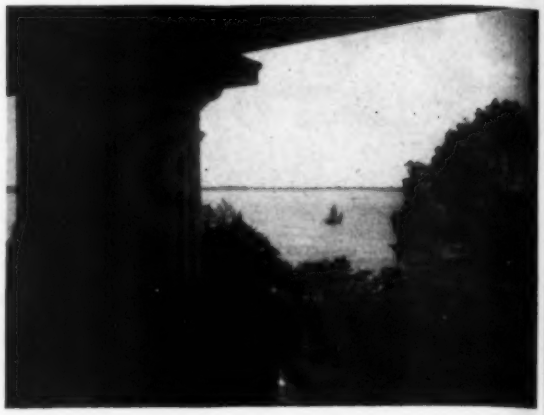
There are three F.E.A.F. airfields on Singapore Island—Changi, Tengah and Seletar—and two in Malaya, at Kuala Lumpur and Butterworth. The three Singapore airfields are R.A.F.-controlled. Kuala Lumpur is a joint-user airfield, part R.A.F., part Malayan Air Force and part international airport. Butterworth is an R.A.A.F. station, the most modern of them all and up to full NATO standard.

F.E.A.F. is commanded by an R.A.F. air marshal—Air Marshal the Earl of Bandon—whose staff is drawn from the three Air Forces. No. 224 Group's headquarters at Kuala Lumpur have recently moved to Singapore, with an R.A.A.F. air vice-marshal currently in command (A.V-M. V. E. Hancock, who is being succeeded by A.V-M. R. A. R. Rae) and again an integrated staff.

Lines of Communication. Although it is an independent Command, F.E.A.F. must link up with the three great Commonwealth States which furnish its components, with the SEATO partners, and with other strategically sited British forces overseas.

To this end, air communications within its own area of responsibility are maintained by F.E.A.F. Within its authority come F.E.A.F. units stationed either temporarily or permanently at Kai Tak civil airport, Hong Kong; Labuan; Katunayake (Negombo), Ceylon; and Gan (Maldive Islands). Combined SEATO exercises have been carried out at Bangkok to which F.E.A.F. operational and transport aircraft have been flown. Air communication is maintained with the U.S.A.F. at Clark Field, Manila, and with Edinburgh Field, Adelaide. Casualty evacuation cases are flown to the R.A.F. base hospital at Changi from Malaya and detachments farther east. Units operating on the ground in Malaya against the Communist terrorists require air transport and support. There is thus a continuous need for military air transport services in F.E.A.F. To meet this overall demand the Command has used Hastings, Valetta, Freighter, Dakota, Pembroke, Auster and more recently Beverley fixed-wing aircraft, and Whirlwind and Sycamore helicopters.

A.V-M. A. A. Adams, C.B., D.F.C., who is Chief of Staff, Far East Air Force



Right, balcony view from the F.E.A.F. headquarters officers' mess at Fairy Point, Changi, Singapore Island. The water beyond the trees is the East Channel, Johore Strait

THE FAR EAST AIR FORCE...

R.A.F. Transport Command and two charter companies (Airwork and Skyways) have provided through air transport between the U.K. and F.E.A.F. Comet 2s and Hastings of Transport Command have carried personnel, despatches and freight. From Singapore to the U.K., casualty evacuation is by Comet 2. On casevac flights overnight stops are made. The Comet is chosen because it is both faster and less fatiguing. There is a military hospital at each stop except El Adem, but from there the military hospital at Tobruk is only 20 miles away; thus any emergency can be quickly dealt with—which is not so at sea, where there may not be a qualified anæsthetist or even a surgeon capable of doing more than an appendix operation.

The Casualty Air Evacuation Centre is located at R.A.F. Hospital Changi and is responsible for all casevac organization movements to the U.K., Australia and New Zealand, including U.K. Army and R.N. personnel. Since the homeward-bound Comets start from R.A.F. Changi the medical authorities in Ceylon and Aden request the O.C., C.A.E.C. (who has the rank of flight lieutenant), to keep seats for patients. P.M.R.A.F.N.S. sisters fly out from the U.K. to Changi by Comet to look after the patients on the homeward run, probably land at Changi at dusk and are off again by eight o'clock the following morning. I was much struck by the keenness and devotion of these nursing sisters and the complete *sang-froid* they display in this tiring duty with its abrupt changes of climate. I think their work is insufficiently known. It deserves much praise. I have seen a Comet bound for R.A.F. Lyneham diverted because of fog to R.A.F. St. Mawgan in Cornwall and land there with a load of sick who were taken over by the station sick-quarters while the tired sisters went to the mess. I know of no women's work for which I feel greater admiration.

A weekly evacuation Valetta flies from Changi to Kuala Lumpur, Ipoh and Taiping and back to bring cases down to the base hospital. All do not necessarily return to the U.K., but only those so scheduled by the O.C., C.A.E.C. For example, a broken fibula or tibia (through games or other accident) is set at the base hospital and the patient returned to his unit unless he is almost tour-expired, when he will be sent home.

The diagnosis and treatment of R.N. and Army personnel are the responsibility of the British Military Hospital in Mindai, Singapore. Policy differs between the Army and the R.A.F. The Army sends home plenty of sick with the object of obtaining fit replacements quickly to maintain effective first-line strength. But the R.A.F. will keep a patient for ten weeks if he can be cured.

The casevac aircraft carry no infectious cases. But there are quite a number of psychiatric patients, chiefly the wives of servicemen, women who do not like the climate or had not wanted to come to Singapore.

The Comets stage home on casevac duty through Katunayake to Aden, where they night-stop, then on next day through El Adem to Lyneham, whence the patients are transported by road to the nearby R.A.F. hospital at Wroughton. The journey can be completed in about 18 hours of daylight flying on two consecutive days. The nursing sisters will have flown for nearly 40 hours and travelled 15,000 n.m. in five days.

The charter aircraft, Hermes, travelled day and night except for one night stop each way. They carried men, women and children, and generally it was considered a pretty strenuous journey by those who flew that way. The out and return journey occupied seven days at half the flying speed of the Comet. This month, Hunting-Clan are to put Britannia 317s on this trooping run, flying to Singapore in four stages in 24 hours without overnight stopping. Fuelling stops are scheduled for Istanbul, Karachi and Bombay.

F.E.A.F. lines of communication are not easy ones. They lie over inhospitable lands and great oceans. They are subject to changes consequent upon political upheavals. Flight plans are liable to be upset by short notice of re-routing. The Middle East "barrier" is a nuisance. Indonesia is overflown after obtaining clearance. R.A.F. aircraft can land in India only with prior permission, which normally takes seven days to obtain, though in emergency this time can be reduced. In practice Transport Command avoids landing in India rather than seek for privileges. Aden - Ceylon may be flown non-stop or the aircraft may be routed through Karachi civil airport and thence non-stop (1,386 n.m.) to Katunayake. On this leg the aircraft keep out to sea well clear of Indian territory and round Cape Cormorin (where an Indian radar checks the passage of all aircraft) at least 30 miles offshore. In a war the situation might become difficult. There is need for a long-range transport with a stage-length of at least 8,000 nautical miles, which could carry either troops or missiles or both, and by missiles I mean both tactical and strategic missiles. Air transport might well be the key to ultimate victory in future war. Insufficient air transport could isolate F.E.A.F. and could in itself be the root of lost local wars.

Singapore Air Garrison. Singapore is an island of lesser area than metropolitan London. Within this area are sited three major and two lesser airfields. Paya Libar, 7½ miles north-east of Singapore city centre, is among the largest civil airports in S.E. Asia. Conforming to I.C.A.O. standard, its single runway is 8,000ft long and with room for ultimate extension to 10,000ft. It is aligned N.E.-S.W., the reciprocal directions of the prevailing biennial monsoon winds. Paya Libar currently controls aircraft over the island between 2,000 and 10,000ft. Above 10,000ft they are free but cannot approach the civil or military airfield circuits below

Marshal of the R.A.F. Sir Dermot Boyle, C.A.S., at Tengah during his recent visit to F.E.A.F. With him are the C-in-C., Air Marshal the Earl of Bandon (right); the A.O.C. No. 224 Group, A.V-M. V. E. Hancock (second from left); and G/C. J. E. S. Norton, station commander

2,000ft without the relevant airfield's flying control permission. This works well enough in present conditions, but, were war to break out, would not do so; and how the new civil government of Singapore, with its leftish tendencies, and the civil aviation authorities, would then mix it with F.E.A.F. and SEATO is a question which ought to be answered in advance.

The oldest air station on Singapore island, Seletar, dates from 1926 when No. 205 (Flying Boat) Squadron was first stationed there. It stands on the northern waterfront, facing the Johore Strait, where it widens like an inland lake. Flying-boats first landed there about 1924. Cobham alighted there in 1926 on his flight to Australia and back in a D.H. 50 floatplane. W/C. H. M. Cave-Brown-Cave used Seletar for his four Southampton flying-boats on cruises to circuit Australia and visit Hong Kong in 1928, a journey of 28,000 miles that occupied 11 months. The Air Ministry bought some land at Seletar and built a hut when No. 205 Sqn. went there. Later this holding was extended to 1,800 acres to include an airfield in addition to the seaplane base. Cave-Brown-Cave was Seletar's first station commander.

No. 205 Sqn. was at Seletar continuously except for the Japanese occupation. No. 209 (Flying Boat) Sqn. joined it about 1945. When flying-boats began phasing out, these two squadrons were combined as 205/209 Sqn. In the summer of 1958 the squadron was re-equipped with Shackletons and moved to Changi because the 1,640 yd runway at Seletar was short for full-load operations. This runway does not quite reach the perimeter fence of the airfield, but it cannot be extended to the boundary because of Chinese squatters who have settled within the airfield enclosure. These squatters came in all over Singapore and Malaya after the Japanese were defeated and before the British administration regained proper control. They cannot be dislodged because they are displaced persons with nowhere to go or to be sent to. The population of Singapore Island has doubled in the past 20 years and housing presents a tough problem for the civil administration. Seletar runway cannot be extended inland because more land cannot be bought. It could be extended into the water, as was done at Gibraltar and Hong Kong. The existing runway permits all current aircraft in F.E.A.F. to alight and take off, if necessary with reduced load, and so meets the needs of the station for everything except operational duties by faster and higher-wing-loaded aircraft.

Before leaving this matter of take-off it will interest former flying-boat pilots to know that normal Sunderland take-off time at Seletar in hot conditions was about 85 sec. With a load of 61,800 lb the run lengthened to 95 to 100 sec. Very rarely, when thus laden, were Sunderlands unable to take off from glassy calm water. At the moment of writing two Sunderlands have been reprieved and remain at Seletar, the last flying-boats in the R.A.F. Another link with the station's past is the popular Seletar Sailing Club founded by G/C. E. J. P. Burling, who followed Cave in command. Burling, now retired, visits the station every English winter to give instruction to club members.

F.E.A.F. headquarters were at Seletar until April 1937 when they were moved first to Union Buildings, Singapore, then to Sime Road until the evacuation in January 1942. Seletar must have become accustomed to losses, for its squadron of Meteor 10 P.R. aircraft moved to R.A.F. Tengah on re-equipment with P.R. Canberras.

Seletar is a five-wing station—flying, administration, equipment, supply and engineering wings are located there. The last two take the place of R.A.F. maintenance units in the U.K. Seletar also houses the Joint Air Photographic Interpretation Centre.

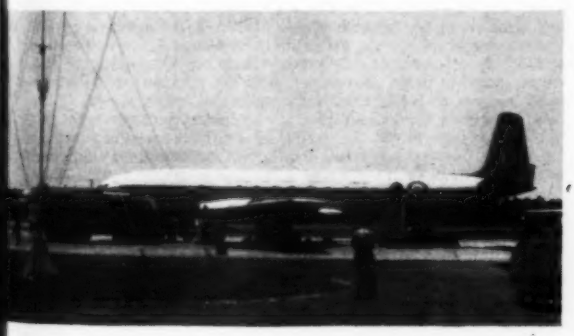
The flying wing controls all flying at Seletar. The runway was resurfaced to take all types of aircraft lightly loaded. When an aircraft carrier is stationed in the Far East, R.A.F. Seletar has to accommodate its reserve aircraft and provide servicing maintenance through the engineering wing. The Singapore Wing of the Malayan Auxiliary Air Force flies Chipmunks at Seletar.

Before the 1939-45 war the engineering wing at Seletar ranked as a maintenance unit. In 1948 (the year of the Communist terrorist outbreak) the station was combined into one unit as R.A.F. Base Seletar, with three wings—admin., technical, equipment. Then it became known as R.A.F. Maintenance Base Seletar, with its functions tied up with A.H.Q. Singapore, located at Changi. When Air H.Q. was closed down and H.Q. F.E.A.F. took over everything, No. 224 Group at Kuala Lumpur assumed the local task of Malayan tactical operations against the Communist terrorists. The engineering wing at Seletar was then organized as it is today, equipped to carry out all servicing for F.E.A.F. up to third line—that is, as much as the R.A.F. does, for fourth-line servicing is a manufacturers' responsibility. I found the organization of the engineering wing running like that of an efficient factory and in a way which for slickness was (I thought) more on U.S. than on U.K. lines. I should judge that F.E.A.F. is well served by its wings at Seletar today. Their ability to maintain their efficiency in the event of war depends on the policy of the Ministry of Defence. Technically it can be done (locally), provided advance policy is correct.

Seletar is an attractive station, with excellent buildings and roads, abundant pleasant vegetation and an expansive waterfront. It seemed sad that the slipways and the long pier with its cranes will have less to do in future, nor are there likely to be so many small marine craft there. The breezy life of airman-sailoring in flying-boats was a thing apart in the R.A.F., a joyous existence with a fascination exclusive to its devotees. The R.A.F. will miss them, and their jargon of bows, transoms, chines, steps and humps that will vanish into the dusty cupboards of forgotten things. But, if there were a state of gloom along the waterfront, it was not echoed in the spacious, airy and most comfortable of all station commanders' offices, where G/C. D. D. Rogers was full of cheerfulness over the great past and hopeful future of the delightful station he commands.

Changi Air Station. Before World War 2, Changi was an Army cantonment. The Japs cut a short air strip there through soft red sandstone. After the war Lord Mountbatten ruled that where there was an airfield the R.A.F. would go in and so Changi became both H.Q., F.E.A.F., and the location for an important air station. The Jap strip is now P.S.P. hardstand for parked aircraft (which are serviced under shelters). A new long runway at right angles to the Jap strip accepts all R.A.F. types, including Comet 2s and V-bombers. Here are both terminal and staging-post for externally controlled military transport aircraft, the main base for the transport aircraft of F.E.A.F., and the base for the maritime-reconnaissance Shackletons of 205/209 Sqn.

Five movement traffic control officers work in four shifts, dealing with all kinds of aircraft including the charter runs from Paya Libar airport for Service personnel. All freight is handled through Changi by R.A.F. aircraft. The M.T.C.O.s are on duty throughout the 24 hours and may clear 100 passengers in one shift, plus freight. They brief all passengers before flight and supervise their transfer from the transit station to the airfield by R.A.F. bus. At the transit station there are sleeping, messing and shopping accommodation; Customs, identity and health-document clearances; and postal and money-changing facilities. (*Continued overleaf*)



A D.H. Comet 2 of No. 216 Sqn., Transport Command, at Katunayake, Negombo, Ceylon

Nostalgic memory: a 205/209 Sqn. Sunderland in Kowloon Bay

THE FAR EAST AIR FORCE...

About three years ago the Far East Transport Wing, which was responsible for all transport aircraft in the Command, became the more simply named Flying Wing, Changi. Under the Station Commander (a group captain) are a wing commander flying and a senior operations officer flying wing, who is a squadron leader. The Air Movement Section is commanded by a senior air movements officer, under whom is the duty traffic handling officer.

F.E.A.F. transport aircraft are organized as far as possible in one-type squadrons. But the F.E. Communications Squadron operates V.I.P. Hastings (furnished with beds), long-range Valettas, ordinary Valettas which calibrate the airfield landing aids throughout the Far East, two Pembrokes and a couple of T.11 Vampires for flying practice.

Hastings make the longest transport runs. They stage at Saigon if unable to fly direct to Hong Kong and must carry enough fuel to divert 700 n.m. to Clark Field, Manila, if necessary, for that is the sole alternate. It takes them about 17½ hours' flying to reach Adelaide from Changi, staging 1,812 n.m. to Darwin and thence 1,408 n.m. to Edinburgh Field. F.E.A.F. Hastings also link Singapore with Iwakuni, Japan. Four Beverleys, recently supplied, carry the heaviest and bulkiest loads. Valettas and Freighters (the latter of No. 41 Sqn., R.N.Z.A.F.) provide normal internal transport within the Federation of Malaya and intercommunication with Labuan, Manila and Hong Kong. Changi to Katunayake (1,627 n.m.) is too far for Valettas and these aircraft stage to Ceylon through Car Nicobar. Before the Shackletons arrived in F.E.A.F., two Valettas and three aircrews at Katunayake maintained air/sea reconnaissance and rescue and shuttle services to Gan. The Valetta squadron supplies aircrews and aircraft for the Air Supply Force, of which more later. One detached Freighter and two aircrews do duty at Kuala Lumpur.

When the M.R. squadron moved to Changi the Rescue Co-ordination Centre also moved there from Seletar. Valettas drop the Lindholme gear, carrying the five packs under their wings.

(*To be continued*)

JET REFUELLING: SOME PROBLEMS AND SOLUTIONS

PART of the stock-in-trade of Shell's Research Centre at Thornton-le-Moors, on Merseyside, is the study of aircraft fuels and aircraft refuelling. A good deal of the Centre's applied effort is devoted to satisfying the thirsts of civil jet transports, whose large capacities and quick turn-round times require special means of getting the fuel aboard in time. High flow-rates and less-dirt-tolerant metering systems operating at high pressures demand very high standards of fuel cleanliness, and freedom from water and the accumulation of static electricity must also be ensured.

Filling the tanks of a jet transport in little more than a quarter of an hour demands a total flow rate of about 1,000 gal/min. Given a hydrant system and large diameter hose this is largely a matter of straightforward engineering, based on the steady development of pit valves, pump controls and so on. (Mobile fuellers are extensively used, but the capacity of even the largest is less than the required 17,000 Imp. gal or so.) A dispenser vehicle is interposed between hydrant outlet and aircraft, and this contains the hose reel, delivery meters, five-micron microfilter, control valves and an air eliminator. For underwing refuelling at these high rates a shock eliminator—a bag-type accumulator or possibly a pneumatic capsule—is also essential if pressure-surge damage to the aircraft fuel gallery or ground equipment is to be avoided. Hydrant outlets normally are arranged in pairs, and one dispenser (the latest Shell type is the Tagus, which has a flow rate of 600 gal/min) is used to fuel each set of wing tanks.

The hydraulic-shock problem has been under study for some while at Thornton, where there is a rig simulating both a full hydrant system and an aircraft fuelling gallery and tanks. The nature of the beast is now well understood; sensitive pressure-transducers transmit information on the transient phenomena arising from variations in flow rate, valve opening and shock pressures to automatic recording equipment on which results can be studied.

A high surge-velocity arises from the considerable kinetic energy which has to be dissipated when the movement of the fluid column is arrested by closing either the valves in the aircraft tanks or shut-off valves in the ground equipment; surge velocity is a function of valve closure time and of the length of the system, and also of the elasticity of the fluid. By introducing air-charged rubber bladder accumulators into the system the velocity can be halved. Two accumulators are being developed, one consisting of a series of inflatable rubber bags along the axis of the fuel line and the other a bottle of conventional accumulator shape. A rapid-sensing pressure control valve in the dispenser isolates the aircraft system from high upstream surge, and suitable units have been developed by Shell for this purpose.

A watchful eye is also being kept on another problem that could arise with fast refuelling. Owing to the nature of kerosine, the rate of dissipation of static electricity to an earthed tank is slow, but static build-up increases rapidly with flow. An experimental result from a system consisting of a supply hose, filter and tank showed that the rate of charge increased from 8μC/sec at 300 gal/min to 20μC at 500 gal/min, and that the amount of charge depends upon what is inserted in the line: for example, the static charge is increased by the addition of a filter. The danger is that the low conductivity of the fuel may cause a sufficiently strong electrical field to develop in the tank vapour space and allow a spark to pass.

To give the charge sufficient time to leak away, a relaxation tank can be introduced into the dispenser vehicle. Its simple purpose is to provide a greater residence time for the fluid passing through. For example, a 30 gal tank will contain for 4.36 sec fuel being pumped through it at 500 gal/min. A more elegant solution is to increase the conductivity of the fuel; at Thornton recently, Shell demonstrated the remarkable results of a chemical anti-static additive which they are developing. Its dilution is only two parts per million and it is apparently most successful in preventing a build-up of charge, although before it can be accepted fuel containing the additive must be subjected to protracted tests to ensure that other properties are not impaired. In any case, this research is a long-term project; no troubles with high static build-up have yet been encountered.

The third aspect of fuel system development under study at the laboratories concerns fuel cleanliness and freedom from water. While higher flow-rates and pressures have aggravated the effects of even slightly contaminated fuel, present investigation is merely an extension of the continuous work of the Shell quality-control system. No filter in production will provide a sharp cut-off in the size of particles passed, and the efficient microfilter used in dispenser vehicles as the final safeguard against contaminated fuel is being further developed: current work is aimed at eliminating all particles greater than one or two microns.

Laboratory evaluation of filters and different types of filter paper is conducted by introducing measured quantities of alumina and magnetic ferrous oxide contaminant (sand and rust) into the fuel and comparing the influent and effluent for solid content, a task that is aided by electronic particle-counting techniques.

With careful treatment of aviation fuel before and during delivery it is possible practically to eliminate free or dispersed water, though no mechanical means is available to remove the small amounts of dissolved water that the fuel may contain: kerosine aviation fuels, which have a higher viscosity and specific gravity than their more volatile counterparts, present something of a problem in this respect. Filter heaters are necessary to deal with the ice formed by this dispersed water and also the water that comes out of suspension when warm fuel is added to cold-soaked fuel already in the aircraft tanks. A Shell syringe and capsule water-detector unit can be used in field service to check the freedom from water of the ingoing fuel, but as a result of their Comet proving flight experience, B.O.A.C. no longer sample the water content of fuel tanks after refuelling a cold aircraft.

Water can be eliminated from stored fuel by settling, by suction or by water separators. A number of the latter are being tested at Thornton; the requirement is that no detectable free water should be allowed to pass. One water separator employs a two-element filter. The first cartridge (which may be fibreglass) is of a hydrophylic nature causing the water droplets to coalesce as the fuel is filtered; they will then sink to the bottom of the filter. The second cartridge is hydrophobic and preferential to kerosine, so that the remaining water gets left behind.

The effectiveness of these devices in ensuring quality control is likely to be threatened only by a human failure, and even this can be guarded against to a substantial extent by the Shell fuel monitor —a "human element longstop" device which, inserted into the supply line as near as possible to the final fuelling hose, will shut off the supply if excessive water is present. Operation is governed by a cartridge of hygroscopic filter papers which swell in the presence of water and increase the back pressure across a pilot valve. This causes the valve to close and, by servo action, to cut off the supply. A number of these valves are being sent for field trials in various parts of the world; if they are satisfactory production will start in six months.

A final aspect of research at Thornton is the work the laboratories are doing on smoke emission during take-offs with water injection. High compression-ratios and the chilling of chambers designed specifically for low pressure-drop are generally to blame for the formation of carbon, but the problem is being investigated on the Shell combustion chamber rigs to see if a modified fuel could help alleviate the problem. It takes an advanced research organization to think like that.

A.T.P.

The Meta-Sokol's cockpit, showing the piston-type control columns with their comfortable spade-grips; the tidy arrangement of the instrument panel, with a "left to right" row of switches and controls beneath it; and the between-seats console carrying flap, undercarriage and tailplane-trim controls

"FLIGHT" PHOTOGRAPHS

TWO AIR TESTS BY MARK LAMBERT:—

I: Handling the Meta-Sokol

LATEST of the Czech private aircraft to be imported is a Meta-Sokol which recently came to Croydon for validation of its Czech C. of A. After inspection it was passed fit without any modification at all. The machine, registered OK-NMB, was flown over by Leopold Brabec with a team of technicians and was imported by the British agent, G/C. Edward Mole, of 3 Red Place, Green Street, London W.1.

The Meta-Sokol is remarkable for having an ample four-seat cabin and cruising at 126 m.p.h. on the power of a Walter M 332 direct-injection engine giving a basic 110 h.p. A supercharger driven by an electric motor can be engaged to raise the power to 140 h.p. for five minutes at sea level. The pitch of the two-blade, metal propeller can be electrically varied and the supercharger can be used continuously above 1,500m (4,900ft). At such a height, a T.A.S. of at least 130 m.p.h. can be maintained. Mechanical retraction of the distinctive reversed-nosewheel undercarriage makes for simplicity, though the main wheels remain exposed to cushion a wheels-up landing. The rear wheel is steered from either of the two pairs of rudder pedals.

A very clean, entirely flush-riveted, all-metal airframe, with control surfaces covered in fabric and shrouded, apparently without any slots or horn balances, all combine to reduce drag and raise both the cruising speed and economy. The large canopy is rigid, slides very easily and is firmly and simply locked shut. It can be jettisoned for escape by parachute and can be slightly opened in flight. Small ventilators are placed in the windscreen. The Meta-Sokol is stressed for normal aerobatics and spinning with two occupants. Trimming, by variable-incidence tailplane, is fully effective.

Just over 24 Imp. gal of fuel are carried in two wing-tanks, giving an extreme range of 680 miles at 3.6 gal/100 miles. Economy is in fact its strong point—and the aircraft can be bought through the British agent for only £4,400, British duty paid and delivered in U.K. with valid C. of A.

When I went down to Croydon to fly the Meta-Sokol, it was bobbing up and down on the tarmac in a strong wind, looking all ready to take off on its own but, though we clambered over it, two or three at a time, it remained fully stable. Handles and a narrow walkaway offer easy access over the wing-roots. To get into a front seat one has to wriggle a little under the windscreen, but the coaming is low and there is a stout leather grip-strap under the windscreen bridge. The front seats slide and tilt at the same time to suit anyone's leg reach, and the seat pans are made with a sharp curve to support the thighs comfortably. The access geometry favours those who climb into back seats.

Though sharply raked, the windscreen is extensively wrapped round and affords excellent visibility sideways and downwards to both sides. In front, the narrow nose does not intrude excessively and taxying presents no visibility problems. Visibility through the canopy is better than in most four-seaters and a tiny Ford Popular-type rear window gives a view of the tail surfaces and beyond. The control column is a wheel on top of a hooked piston emerging from the instrument panel. It looks like a wheel but works like a stick and is very comfortable to use. Propeller pitch is altered by pressing one of two buttons in the port wheel to "blip" the pitch to any fine or coarse setting. Pitch range is not sufficient to make failure of the electrical control critical in any phase of flight.

Instrument layout is clear and logical, with flight and engine instruments grouped on a wedge-shaped central panel. Various electrical switches and controls are ranged in a row along a transverse shelf, with subsidiary fuel controls below. The plunger throttle is in the middle, surrounded by a series of levers for fuel tank-selection, mixture and magnetos. Everything is arranged so that one can move from left to right flicking up groups of controls (battery, dynamo, starter isolator, radio isolator, magnetos, throttle and fuel) in rapid sequence. The centrifugal supercharger is engaged by pulling out a large plunger near the throttle. One raises fuel pressure by a couple of quick tugs at the appropriate plunger, switches on the primer circuit and primes with another plunger, and presses the starter button. A separate switch well to the right is used to turn on the turn-and-slip indicator and a fire-extinguisher plunger is on the far right.

The engine will idle very slowly indeed and both pairs of rudder pedals are connected to the rear wheel so that either pilot can taxi. Cable-operated wheel brakes are actuated from toe extensions on the port rudder pedals only and can be parked, Harvard-fashion, by pressing and pulling a small catch far forward under the instrument panel. Parking catch is released by pressing the brake pedals.

Flap, undercarriage and tailplane-trim controls are located on a console between the pilots. The flap lever operates like that of an Auster, but slightly more easily, to select either the 15 deg take-off or 35 deg landing extension of the small split flaps. The trim wheel is small and on this new aircraft was rather stiff, but it should loosen with use and can then be turnable by running the

"I found no difficulty in manœuvring according to the photographer's motioned instructions . . . formation flying is always a good indication of manageability"

HANDLING THE META-SOKOL . . .

The characteristic stance of the Meta-Sokol results from the reversed-nosewheel undercarriage. Note the sharply raked, wrapped-round windscreen

palm of the hand along the knurled rim. The related indicator, close by, is very clearly marked.

Undercarriage retraction gave me some trouble at first, but it became simple with a little practice. The main action is from a crooked lever with a good big hand-grip which is easy to move from the fully rearward "down" position to the fully forward "up" position. But first, a small lever must be moved over to unlatch the locks and then a good hard shove down is needed actually to effect the release of the locks. Another shove afterwards is required to engage the up-locks. Little red and green tell-tales beside the locking lever indicate lock-position. Additional little tell-tales in the wing show when the down-locks are engaged. The physical effort required is not excessive and the locks can be engaged by feel with a subsequent glance to make quite sure of things.

Having ascertained these various points with the aid of an interpreter, we set off with myself in the right seat, Brabec in the left and the Czech interpreter behind. The tanks were about half full. Apart from a sharp vibration when accelerating from the very lowest r.p.m., the little Walter ran smoothly and was precisely controllable. I would say it was a fraction rougher than a small Lycoming, but just as responsive. The take-off, by Brabec, was a wee bit long, but the climb quite respectable, especially when the aircraft was "cleaned up." The blower was disengaged for the climb and we settled to chase the Proctor in which our photographer was waiting for us.

I took control just as we came into close formation and found no difficulty in manœuvring according to the photographer's motioned instructions. Power response was excellent and, despite extremely bumpy weather, I had no difficulty in staying in close and keeping where I was wanted. I feel that formation flying is always a good indication of manageability.

Photography completed, I flew around for a while trying the controls. At cruising speed the stick forces were light in the first bit of movement and heavied up considerably with further deflections. The rate of roll attainable was not very high, but steep turns required no particular co-ordination and could be reversed with the rudder pedals free without excessive adverse yaw. I tried one quick stall with the aircraft clean. It came with some warning at about 60 m.p.h. I.A.S. and was as docile as one could wish. Neither nose nor wing dropped and recovery was immediate on centralizing the stick.

We then landed to drop the passenger. Approach was made at 80 m.p.h. with plenty of power because of the very strong wind and was not representative of approach capability. I took over for the touch-down, flying through a long float and straight on to three points with the minimum of round-out. The whole procedure was a little more long-drawn-out than I would like, but ridiculously easy, with precise control, particularly on the elevators. Once on the rough grass of Biggin Hill, the undercarriage gave an excellent ride and direction was simply maintained. Rear-wheel steering was heavy and not too responsive, but adequate. The tail-wheel connection can be over-ridden in the usual way. Despite the close-grouped wheels, stability on the ground seems to leave nothing to be desired.

The Meta-Sokol has a distinctive wing plan-form and sharply tapered fuselage. Cruising speed is 126 m.p.h.

I next took the left seat and started up. That was simple and quick. Rear wheel steering was heavy and took a little practice, but was effective. With someone in the back seat as I later had, it was a good deal heavier and more sluggish, because of the extra weight right on top of the wheel. To the standard pre-take-off checks are added a propeller pitch-setting one "blip" short of fully fine to avoid overspeeding at take-off. The blower is engaged and flaps extended to the first stop.

On opening up, acceleration is good and directional control very easy. I was told to pull off at 55 m.p.h. and climb at 80 m.p.h. Allowing a pause while speed built up, I found I had to watch the A.S.I. and r.p.m. fairly carefully concentrating at the same time on manipulating the undercarriage. During about three take-offs I learnt the knack—and it is no more than that. Raising of take-off flap causes no perceptible sink.

We then climbed up to 1,500m (almost 5,000ft) to try some spins. In calm air the Meta-Sokol handled very smoothly and flew virtually hands-off. Rate of roll was still moderate, but response very smooth. While climbing at about 4,000ft we tried the supercharger and the rate of climb went instantly from 400ft/min to 800ft/min. Above 4,500ft it can be used continuously and will really give a very worthwhile cruising T.A.S. Otherwise one settles into level flight and coarsens pitch progressively as the speed builds up to keep the r.p.m. at about 2,300 with an intake pressure, at that height, just below 0.7 atmospheres. The aircraft seems to get "on the step" and the nose goes well down. Visibility for map-reading is exceptionally good.

OMNIPOL META-SOKOL

(Walter M 332, direct injection, supercharger, v.p. propeller, giving 140 h.p. with and 110 h.p. without supercharger)

Span, 33ft; length, 24ft 6in; wing area, 136 sq ft; empty weight, 1,177 lb; useful load (inc. four occupants, 24 Imp. gal fuel and 11 lb baggage), 880 lb; gross weight, 2,060 lb; wing loading, 13 lb/sq ft; max. s.l. speed with supercharger, 147 m.p.h.; cruising speed, 126 m.p.h.; landing speed 59 m.p.h.; service ceiling with supercharger, 16,400ft; take-off run, 870ft; range, 680 st. miles; fuel consumption, 3.6 gal/100 miles.

Brabec took over to demonstrate spins. He made a three turn spin in each direction and then a one-turn spin in each direction and recovered after a total height loss of only 2,100ft. Each time the aircraft was put into the spin and recovered with absolute precision using all three controls. All spins were remarkably smooth and did not dislodge a satchel lying on the rear seat. Brabec then showed minimum speeds at 65, 60 and 55 m.p.h., each time waggling wings to demonstrate full control. Half- and full-flap stalls followed at 45 m.p.h. each, again with absolutely instant recovery when the stick was merely centralized. Neither wings nor nose dropped. Then he flew the aircraft clean at 2,500 r.p.m. at 50 m.p.h. with the nose sharply up but under full control.

Finally we landed, picked up the interpreter and returned to Croydon. It was during severe turbulence that I noticed an odd habit the Meta-Sokol has of snaking sharply in rough air. It will fly hands-off, but oscillates sharply from side to side intermittently. The fin might well be altered to eliminate this, although the snaking is no worse than, for example, the waffling of a Gemini in rough weather.

Back at Croydon, I decided to test my impression that the Meta-Sokol could use more drag on the approach. I decided to make a glide landing into the middle of the field from a position which I would think desirable in an aircraft of this type, making allowance for a very strong wind. The 80 m.p.h. I chose in deference to turbulence and wind gradient on the 170 runway at Croydon, was probably too high, but only a long side-slip got us on to the chosen point. It is, however, unfair to judge such a quality in a blustering wind with a strange aircraft. Unfortunately, there is insufficient clearance between wing and ground to allow greater flap deflection.

All in all the Meta-Sokol gets a remarkable amount of energy out of a small and very economical engine. It is completely viceless, and its simplicity and excellent visibility are great assets. It is comfortable, roomy and remarkable value at its price.

TWO AIR TESTS BY MARK LAMBERT:—

2: Handling the Tipsy Nipper

GOING aviating in a small way need not necessarily be a frustrating experience. It most certainly is not so in the Tipsy Nipper. At Kidlington recently, the Belgian test pilot Bernard Neefs threw the little aircraft about most excitingly despite a very strong wind and made a considerable impression. I myself had a chance to fly it from White Waltham a few days later, on a sunny, blustery day which would try any ultra-light. I thoroughly enjoyed myself. The aircraft has fighter-like manœuvrability, is fully aerobatic and has a very respectable 90 m.p.h. cruising speed. You sit snugly inside the little beast as it snarls its way around the sky, steep-turning on a pin-head and looping about its wing-tips. On the ground, you drive it like a scooter; and it is said that landings have been made in ploughed fields.

Best news of all is that Fairey are embarking on a batch of 50 in Belgium and that Fairey Aviation Ltd. are preparing to market the aircraft in Britain. It should sell here for under £1,000. Many different scales of kit will also be available.

Preliminaries for my flight from White Waltham consisted of an external inspection, cockpit check, engine warm-up and some taxying. A walk round with Fairey test pilot John Morton brought various structural features to light. The 19ft 8in wing is based on a wooden main spar with plywood-covered leading-edge and fabric aft. The ailerons are attached on the simplest hinges, the gaps here and at the elevator being sealed by glued-on strips of fabric. Wing-tips are cut off square with the minimum fuss and there appears to be no wash-out. Aspect ratio is 4.8, mean aerodynamic chord 4ft 1½in and dihedral 5.5 deg.

The fuselage is a welded steel-tube carcass clothed with wood and fabric aft while glass-plastics mouldings form engine cowling, propeller spinner and the under-fuselage forward. The light-alloy fuel tank, ahead of the cockpit, forms part of the skin. The tank holds sufficient for 310 miles with 30 min reserve.

A conventional bungee-sprung, A-frame main undercarriage has an 11in travel and carries two small, self-lubricating wheels fitted with dainty little disc brakes. The single discs are in fact held well clear of the hub by a number of bolts; and braking

AVIONS FAIREY TIPSY NIPPER
(HEPU Volkswagen giving 40 h.p.)

Span, 19ft 8in; length, 14ft 9in; empty weight, 360 lb; gross weight, 660 lb; wing area 80.5 sq ft; max. speed, 100 m.p.h.; cruising speed, 90 m.p.h.; take-off run, 110 yd; landing run, 130 yd; landing speed 36 m.p.h.; range, with 30 min reserve, 310 miles; normal fuel, 7.5 Imp. gal.

energy is applied by diminutive calipers operated by cable from a bicycle brake-grip on the top of the control column. The nose-wheel is of the same size and permanently connected through a spring to the rudder pedals to provide steering on the ground. Virtually no maintenance is required and adjustments should be extremely easy to make. The HEPU Volkswagen engine, though fitted with single ignition, has been tested and approved by the West German authorities. A little German Hoffmann wooden propeller is fitted.

Cockpit arrangements are exceptionally good. The single-piece clear-view canopy opens and shuts firmly and easily, does not rattle and seems to let in no draughts. The pilot sits on a moulded plywood seat with ample leg-reach to a pair of rather narrow rudder pedals. The stick is well placed and full lateral movement can be obtained without more than touching an average thigh. In flight no interference is noticed. A most attractive feature is the extra lateral space afforded by extending the cockpit into each wing-root so that the elbows can be spread or propped. The "floor" of these little compartments is transparent, giving a clear view of the wheels and beyond. Visibility all round is obstructed only in the directly rearward direction by the narrow fuselage and sideways by the wing. The ground can be seen 10ft ahead of the nose. Interior furnishing is surprisingly plushy, and there seem to be no sharp edges to bark the knuckles.

One climbs into the Nipper by depressing a light-alloy flap in the back of the port wing-root. A step in this panel allows one to climb up into the cockpit, keeping the weight of the body well forward to avoid tipping the aircraft back onto its tail-skid. After entering, the flap is hooked up into its spring stop with the toe. Full shoulder harness is provided and there is a small "slit trench" behind the low back-rest to accommodate an overnight bag.

The main spar passes through the fuselage over the pilot's knees. A.S.I. (in km/hr), altimeter (single-pointer in metres), engine r.p.m. and liquid compass are above this, while the magneto switch and oil pressure gauge are on the right shelf and oil temperature gauge to the left. Both gauges are car instruments.

The tension of a small spring at the base of the control column

"Flight" photograph

The Tipsy Nipper, photographed from "Flight's" Gemini, with Bernard Neefs at the controls. The Nipper cruises at 90 m.p.h. and is aerobatic

can be varied by a clip-and-ratchet system further up to apply some spring bias to the elevator. In fact this is hardly required and serves mainly to make fine adjustments for hands-off cruising. Trim changes are in any case very small and the control forces very light. The throttle lever, without friction nut, is mounted on the port shelf. There is no mixture control.

Engine starting is by priming with the throttle through the accelerator pump while the propeller is being turned. A few twiddles with a strong hand close to the propeller hub produce the required noise. Minimum take-off oil temperature is 40 deg, but the gauge reads only from 50 deg upwards. With single ignition, magneto checks are pointless. No trim setting is required. It remains only to release the little catch holding the brakes on and the Nipper is ready to take off.

It was a long way from the apron to the take-off point near the caravan, so John Morton told me to taxi around a bit to get the feel and then take off along the apron, towards the western hangar. I opened up the little engine and started driving around as if the Nipper were a scooter. It turned very tightly and could be exactly steered. As the brakes were not set to give maximum retardation it was easier to turn away from an obstacle than to try to stop. After weaving around among the parked aircraft, I lined up for the take-off past the hangars. It went perfectly, with precise control until I raised the nosewheel very slowly, in readiness to unstick. Then the aircraft suddenly jumped ten feet into the air and I had to hold it down. It felt as if, in the final few degrees of raising the nose, the c.g. suddenly passed behind the main wheels to launch me into the air. I imagine I was a bit hasty in getting off, but the Nipper felt quite ready and remained definitely airborne afterwards.

Climbing away in a rough wind I soon realized that I had quite exceptional manœuvrability and control, with very light stick forces. Once accustomed to the strong turbulence, I found the Nipper was quite stable. Cruising at 500m, I checked neutral stability on the ailerons and ample rudder control. Reversing turns with feet off the rudder bar produced virtually no adverse yaw. Longitudinal stability was not easy to check because the Nipper was trimmed nose-heavy at the moderate speed at which I first flew. Visibility was good except where the wings intruded; and at this blind spot the little underside windows were very helpful. The lateral shelves also formed an excellent writing desk and stowage for notebook and pen.

A few normal turns proved pleasant and I tried steep turns. Speed fell off fairly rapidly to 85 km/hr but the Nipper fairly spun round with the inboard wingtip apparently moving backwards over the ground below. Normal cruising r.p.m. are 3,200, but the engine can be run at full bore the whole time without straining anything. The noise level is fairly high, but the speed builds up well to the advertised 90 m.p.h. The Nipper is then very stable and I let it fly itself in bumpy air while I wrote a whole page of notes.

I stalled it out of a steep turn and found only a little shake back towards level flight at a relatively high g value. Straight stalls were remarkable—just a brief jerk of the nose down to the horizon and no further. Though I held the stick hard back I had complete aileron and rudder control the whole time. At 3,000 r.p.m. the nose rose so high without a trace of a stall that forward vision was blotted out by the wing. Power-off stalling speed was 40 km/hr I.A.S. and there was plenty of control in hand to make sharp pull-ups at the very last moment. The Nipper is exceptionally tolerant to high g close to the stall. At low speeds there is pronounced adverse yaw when aileron is applied.

By now I felt real confidence and climbed quickly to 1,000m

(*Concluded at foot of p. 652*)

The fail-safe, safe-life features of the 748 are achieved with a light and simple structure

AVRO 748

A New DC-3 Replacement: First Detailed Figures Released

THE first official figures to be released concerning the Hawker-Siddeley Group's twin-Dart feederliner confirm that the Avro 748 is intended as a contender for the DC-3 replacement market—and that it is to be a direct competitor to the Handley Page Dart Herald and Fokker Friendship. Data for the three types, set out in the table on the right, show how closely the specifications of the three aircraft compare. What the table cannot show is the most obvious distinguishing feature of the Avro 748: the low wing, which feature alone may make this design particularly attractive to certain operators.

Structurally, the aircraft has been kept deliberately simple and light. Magnesium or zinc-bearing aluminium alloys are not used and structural materials are limited to L.72, L.73 and L.65. Fail-safe principles are employed throughout and the airframe should also have an "almost infinite" fatigue life; in line with the developing philosophy of fail-safe, the design provides for easy examination of the structure and for a slow rate of crack propagation. Use is also made of duplicate load-paths and crack-stopping structural joints. Avro claim that, because of the attention that has been paid to accessibility, no part of the structure will be hidden from inspection. Bonded joints, for example, may in certain circumstances be difficult to inspect, so none are used and structural repairs can be carried out by conventional methods.

An outline of the structure is shown in the makers' drawing above. The wing is of two-web construction embracing integral tanks, flaps and ailerons are single units and mushroom-headed rivets are used everywhere except on the upper surface of the wing. Structural joints have generally been avoided to save weight, maintenance and fatigue troubles.

Doors under the fuselage open for access to hydraulics and ground servicing connections (in the nosewheel bay) pressurization systems (under the forward cabin) and electrics and the electric flap motor installation (aft of the wing).

Choice of Rolls-Royce Dart 514 powerplants for the Avro 748 has presumably been governed by the exceptionally long overhaul life which can be guaranteed—it already stands at 2,000 hr. Vickers experience with the Viscount 800 has also been drawn upon in installing the RDa.6; the two installations are basically similar and Avro use Vickers powerplant components. Automatic water/methanol injection to restore take-off power (1,600 s.h.p. at sea level, I.S.A.) at high ambient temperatures is an optional fitment.

Propellers are 12ft diameter Rotol, electrically de-iced, and a Rotol accessory gearbox is mounted near the top of the nacelle aft of the firewall. Reverse-pitch facility is not provided, ground fine pitch being used to reduce the landing run, but automatic pitch coarsening is available.

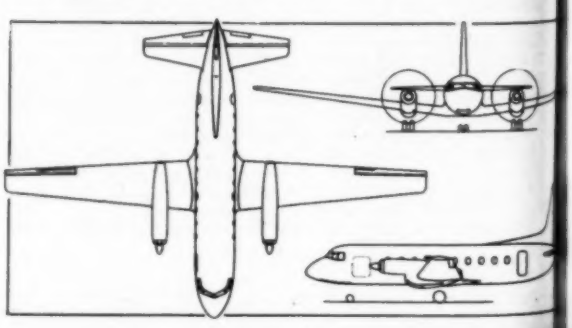
Systems. Duplicated air supply and pressure control systems maintain the cabin at a differential pressure of 4.2 lb/sq in (8,000ft cabin altitude at 20,000ft) and circulate 50 lb of fresh air per minute. Cabin temperature is maintained above 20 deg C and ram-air cooling is provided for hot climates. A cold air unit can be supplied.

Two engine-driven hydraulic pumps energize the forward-retracting undercarriage, nosewheel steering and brakes. For the last-named system a pressure reserve is contained in two accumulators. Emergency undercarriage lowering is by hand pump or by free fall. The electrical power system is 28-volt D.C. with a secondary 115-volt, 3-phase, 400 c/s system and a separate 200-volt, 3-phase variable frequency supply for engine and propeller de-icing. Pneumatic de-icer boots can be fitted to the wings and tail if specified.

Two 550 gal integral fuel tanks, one in each wing, supply fuel to their respective engines through two electrically-driven fuel pumps on each side, but one pump alone will meet the maximum demand of the system and the supply can be cross-fed. Over-wing refuelling is normal but underwing refuelling can be fitted.

In calculating equipped weight, allowance has been made for

Viscount components, Dart engines and big elliptical windows are proven features of Avro's new design

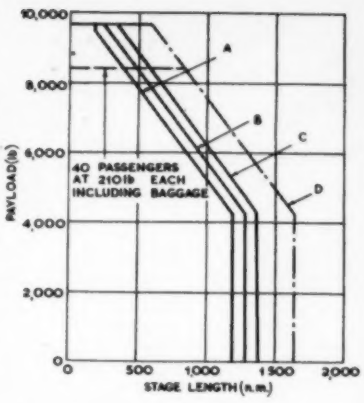


ROLLS-ROYCE DART-POWERED DC-3 REPLACEMENTS

	Avro 748	Dart Herald	Friendship
Span	95ft	94ft 9¼in	95ft 2in
Length	67ft	71ft 11in.	75ft 9in
Powerplant	Dart 514 (RDa. 6)	Dart 527 (RDa. 7/2)	Dart 511 (RDa. 6)
Propellers	Rotol 12ft	Rotol 12¼ft	Rotol 12ft
Cabin Dimensions:			
Length	46ft 6in	43ft 8in	47ft 6in
Width (in)	97.2	102	106
Height (in)	76.6	75	80
Volume (cu ft)	1,990	2,198	1,620
Seating capacity	36–40	36–47	32–44
Freight door, height	4ft 6in	5ft 4in	5ft 10in
Freight door, width	4ft	5ft 5in	7ft 7¼in
Max. t.o. weight (lb)	33,000	37,000	35,700
Max. landing weight (lb)	33,000	37,000	34,000
Payload (lb)	9,666	10,160	10,278
Fuel capacity (Imp. gal)	1,100	1,080	1,100
Balanced field length (ft)	3,500	3,600	3,810
Landing distance from 50ft (ft)	2,310	2,260	2,140
Range with max. payload, no allowances (n.m.)	580	510	590
Rate of climb at s.l. (ft/min)	1,250	1,580	1,290
Cruise at recommended r.p.m. (kt)	230	241	236
Basic price (approx)	£170,000	£185,000	£215,000

These payload range curves assume I.S.A., 230 kt T.A.S. cruise at 20,000ft, 320 lb water/methanol, max. take-off weight 33,000 lb. Reserve fuel: A=5 per cent+45 min. hold+200 n.m. diversion; B=5 per cent+45 min hold+100 n.m. diversion; C=5 per cent+45 min hold; D=none

Left, a "Flight" table. F-27s with RDa.7s have a higher performance



twin V.H.F. sets, an A.D.F., and a marker receiver, but much additional equipment—including I.L.S., V.O.R., H.F., weather radar, etc.—can be installed to customer's option. Most of the components used on the Avro 748 systems have already seen service in the Viscount and have been selected because of their long overhaul life.

Performance. Special attention has been paid to the need to operate the Avro 748 from hot, high airfields with limited runway lengths and semi-prepared surfaces. Each main leg, for example, is equipped with twin low-pressure tyres, and the large wing area and high aspect-ratio help to reduce payload or fuel restrictions under extreme conditions. For instance, no limitation on take-off weight is encountered in I.S.A. conditions below 4,300ft. With both engines operating, take-off at maximum weight to 35ft can be made in 2,520ft and in the one-engine-out case C.A.B. S.R.422A requirements are met. The use of water/methanol is assumed, but where it is not installed range can be increased by 70 n.m. The still air range with no reserves is 1,630 n.m. with a payload of 4,420 lb. Given 2,000 hr annual utilization, direct cost—based on the S.B.A.C. method corrected for actual RDa.6 maintenance costs—is 69.5d per aircraft n.m. on a 200 n.m. stage length; equivalent, with 40 passengers, to 1.74d per seat n.m. This is claimed to be substantially lower than existing aircraft in the same class, particularly over short stages.

Payload Accommodation. The cabin is particularly spacious. Passenger loading is through a 5ft 3in×2ft 6in door (to which folding steps can be fitted) on the port side and two doors are provided on the starboard side for loading baggage or freight; the forward door can accommodate a Dart engine. Seats are arranged four-abreast up to a maximum of 40 at 36in pitch and a mixed passenger/freight layout is possible by installing a movable partition. Provision is made for a galley and all layouts include a toilet and ample baggage space. Crew complement is normally two pilots and a steward.

Sir Roy Dobson, managing director of Hawker-Siddeley Aviation, recently left for New Delhi to discuss the aircraft with Mr. Krishna Menon, the Indian Minister of Defence. He said that India had shown "a great deal of interest."

PATTERNS OF POWER: JAVELIN 7s OF FIGHTER COMMAND

Led by S/L. D. W. Smith, flying with the squadron commander (W/C. N. Poole) as his navigator, six Gloster Javelin FAW.7s of No. 33 Sqn. thrust into the Durham skies from their base at Middleton St. George. The squadron, formerly equipped with A.W.A. Meteor N.F.14s, received its Javelin 7s from last July onwards and was the first unit to be equipped with them "Flight" photograph

The new Cessna 210 (left) is powered by a 260 h.p. Continental engine with fuel injection and should cruise at 190 m.p.h. F.A.A. certification and approval for production are reported to be imminent, and the price of the four-seater machine is quoted as "under $22,500"

Sport and Business

THE new airstrip in the grounds of Woburn Abbey was well and truly inaugurated last Saturday when some 90 aircraft landed there at the invitation of the Duke of Bedford. The crews were entertained to lunch and tea in the Abbey and given coach tours of the extensive grounds. A time-of-arrival competition proved all too easy . . . a Rapide won it standing on its nose—literally. Unfortunately, it sustained considerable damage.

The airstrip itself lies close to the Abbey, in a hollow of soft, sharply undulating turf beside a series of ornamental lakes, a few miles south-east of Bletchley, and not far from the A5 road. A strong cross-wind was unpleasantly stirred up by some trees close by and many aircraft had a little difficulty in getting down in the 600yd available. A second runway, at about 60 deg to the first was on a slope.

The 90 visitors consisted mainly of the usual fleet of Tigers, Maggies, Proctors, Moths and some Rapides, reinforced by Klemm G-AEMW, Motor Tutor, Aeronca, Comper and Globe Swifts, several Tipsys and Piper Cup Coupé G-AFSZ. But these were joined by new blood, the Linnet, several Rollason Turbulents, Jackaroo, the Rollason parachuting Tiger *Sue Burges*, and the D.H. Turbi. The writer joined in with Fairey's Tipsy Nipper OO-NIF, the subject of an air test on p. 635. Incidentally, the Nipper covered 34 miles in 23 min with a strong 90-deg cross wind, making an average speed of 89 m.p.h. and flying virtually hands-off all the way. It behaved extremely well on the very difficult Woburn strip. The Shuttleworth Pup and "Brisfit" put up a good dog-fight during the afternoon, and Mike Reilly made a parachute descent.

OFFICIAL OPENING of the Yorkshire Aeroplane Club's new clubhouse at the Leeds-Bradford airport, Yeadon, was performed on April 25 by Alderman F. H. O'Donnell, chairman of the aerodrome committee. The club is in effect a recently formed combination of the original Yorkshire Aeroplane Club (which was formed 50 years ago and whose operations ceased over a year ago at Sherburn-in-Elmet), and the Yeadon Aero Club, which previously operated at Yeadon, but which had also been forced to close down. When the idea of re-forming the Yorkshire Aeroplane Club was suggested, Arnold Wilson and Ronald Braime (who had operated the club at Sherburn) agreed to transfer the name; the directors of Yeadon Aero Club gave their club records; and the Leeds-Bradford joint aerodrome committee offered suitable premises.

A parent company (Yorkshire Aeroplane Club Ltd.), the directors of which are Frank Leach and Albert Barker, now owns the club and provides servicing, overhaul and repair facilities. The chairman of the club is L. Reddell and the chief flying instructor is Arthur Carvell.

MIDLAND AERO CLUB, Elmdon Airport, this year celebrates its 50th year of operation. Following the annual general meeting of the club on April 23 the officials and committee of the club are: Walter A. Holland, chairman; D. A. Swan, secretary; W. S. Cox, treasurer, D. Holmes, flying member; Mrs. Sylvia Haines, social affairs member; J. P. Busby, G. W. Haines, K. Holland, B. A. Willcox, committee members; Eric Bradley, A.F.C., chief flying instructor; F. Walter and J. J. Muldoon, flying instructors, and James Willis, steward.

THE WORLD GLIDING CHAMPIONSHIPS next year will be held in Western Germany during June, it was decided at a recent Fédération Aéronautique Internationale meeting in Paris. The site and dates have not yet been chosen.

THE SLINGSBY T.21b constructed by pupils of Leighton Park School, Reading, led by their physics master John Simpson, was due to be officially named "Min" at Lasham Gliding Centre yesterday (May 7). The ceremony was to be performed by Sir John Wolfenden in his capacity as chairman of the Central Council for Physical Education in Sport.

This Slingsby T.21b was built by boys of Leighton Park School, Reading, led by physics master John Simpson, seen here in the cockpit with one of the pupil constructors

AMONG THE ENTRIES (list below) for the 1959 National Gliding Championships, which begin at Lasham Airfield, Hampshire, tomorrow (Saturday, May 9) and continue until Monday, May 18, will be a Breguet 905 Fauvette flown by Tony Goodhart. This is the first production model of the type and is on loan to Cdr. Goodhart pending the delivery of his own aircraft, the sixth production machine, in June.

On the first two days of the championships Lasham's new hangar will accommodate the first international glider trade fair, sponsored by the British Gliding Association. British, French, Polish, Swiss and West German exhibitors will be showing gliders and associated equipment. Among foreign visitors expected is a Russian Trade delegation.

1959 NATIONAL GLIDING CHAMPIONSHIPS ENTRIES

League 1: 1, P. A. Wills (Skylark 3); 3, A. Coulson (Skylark 3b); 4, W. A. H. Kahn (T.42 Eagle); 6, H. C. N. Goodhart (Skylark 3); 8, G. H. Stephenson (Skylark 3); 9, C. A. P. Ellis (Skylark 3); 10, Peter Scott (T.42 Eagle); 11, Lorne Welch (T.42 Eagle); 15, Paul Minton and B. Davey (Skylark 2); 16, N. W. Keeron (Skylark 3b); 18, C. Green (Skylark 2); 19, J. Messervy and Mrs. Ann Burns (Skylark 3b); 20, D. D. Carrow (Skylark 3b); 32, H. R. Dimock (Sky); 35, D. B. James (Skylark 2); 41, R. Rutherford (Skylark 2); 42, D. A. Smith (Skylark 3); 44, A. H. Warminger (Skylark 3); 49, P. R. Hampton, D. Scallon and J. H. Holder (Skylark 2); 60, D. H. Kaye (T.42 Eagle); 64, J. M. Hands and C. W. Bentson (Sky); 66, F. G. Irving and W. N. Tonkyn (Skylark 3); 67, G. E. Burton (Skylark 3); 71, B. Thomas, D. R. Elrington and J. Tweedy (Sky); 72, A. J. Deane-Drummond (Olympia 419); 73, K. C. Fitzroy (Skylark 3b); 74, L. Bayley (T.42 Eagle); 75, D. H. G. Ince (Olympia 419); 81, A. T. Morgan and D. Stowe (Skylark 2); 86, A. Gough (Olympia 419X); 89, J. Williamson (Olympia 401); 90, A. D. Piggott (Olympia 403); 100, G. A. J. Goodhart (Breguet 905); 101, P. Neilson, G. Wass and M. Wilson (Skylark 3b).

League 2: 2, I. Paul (Skylark 2); 7, J. Inglesby (Olympia); 12, E. G. Shephard (Skylark 2); 14, R. Bishop and G. R. Hearsey (Olympia); 22, J. C. Everitt (T21b); 24, E. Clarke and A. N. Other (Kranich); 26, N. Maygothling and F. Allen (Olympia); 28, K. Newholm and A. N. Other (Olympia); 29, J. Crowshaw (Gull 4); 33, D. W. Corrick and K. R. Brown (Skylark 2); 37, A. H. Baynes, K. W. Blake and J. B. Jefferson (Skylark 3b); 40, G. H. Lee, A. W. F. Erskine and G. H. Nixon (Olympia); 45, J. C. Riddell (Skylark 1); 48, R. I. Tarver and H. N. Gregg (Olympia); 52, T. G. W. Potts (Skylark 2); 53, A. W. Doughty and E. Westman (Kite 2); 56, T. G. Phillips, G. S. Naumann and G. R. Whitfield (Skylark 2); 58, Sir Charles Dorman, D. J. Corbett, J. M. Ibberson and A. J. Adair (T.42 Eagle); 61, P. C. Dirs and C. P. A. Jaffery (Olympia); 62, S. R. Dodd and J. Westhorpe (Skylark 2); 63, F. W. L. Shepherd and E. Stark (Skylark 2); 65, Mrs. R. Harwood, B. Masters and H. Mottam (Skylark 3); 68, R. T. Wilbie and D. C. Snodgrass (Skylark 3b); 69, D. C. Kerridge and A. N. Other (Olympia); 76, D. M. R. Riddell and M. Fairman (Meise); 78, A. O. Sutcliffe and J. D. Jones (Skylark 2); 80, J. E. G. Harwood and D. G. Goddard (Swallow); 84, O. W. Naumark and G. A. Thomson (Olympia); 87, E. T. Ware and W. Longley (Olympia); 93, R. Marshall (Olympia); 94, R. A. Hellewell and A. D. Hill (Swallow); 95, H. Docktor (T21b); 97, K. Aldridge (T.42 Eagle); 98, R. C. Pick and S. Morrison (Swallow); 102, K. O'Riley, R. P. Hubbs and R. Parkinson (Olympia); 103, G. T. Collins and B. O. Warmington (Olympia); 104, D. Cunningham, P. Berthelsen and L. Glover (T21b); 106, B. R. Wright, M. Randle and R. B. Swift (Olympia); 108, V. C. Carr (Olympia); 120, P. G. Burgess (Skylark 2); 121, G. A. Coatesworth (Meise); 122, B. Lastowski (Olympia).

RETROSPECT

From "Flight" of May 8, 1909

What the Wrights Think of the Aero Club's Flying Ground: During their visit to the Aero Club's flying ground at Sheppey on Tuesday, and also after their return to London that day, it was made abundantly clear both by Mr. Wilbur Wright and his brother that they were agreeably surprised with what they had seen. "This is the best flying ground I have ever seen. It is much superior in every way to those which we have used elsewhere. Here we have ample room for a ten-mile flight without obstruction, as against our four or five hundred yards in the States, and even if the wind is apt to be stronger its relative steadiness is more than adequate compensation for its greater strength." As regards the nature of the surface, Mr. Wilbur Wright was also enthusiastic in his praise. "Our experiences in Italy showed that runners slide quite easily on smooth grassy ground if the surface is damp, so that here we could dispense with any starting-weight or rail." The primary object of the visit to Sheppey was to inspect the Wright machines which are in course of construction in Messrs. Short's factory down there, but the opportunity was also seized upon by the Aero Club for introducing the brothers to the new ground, and several members of the Committee escorted the party to Shellbeach by motor car.

X-15

THE WORLD'S FASTEST AND HIGHEST-FLYING AEROPLANE

WALKING around the X-15 one sees a rather missile-like aircraft, with a long cylindrical body, small stubby wings mounted well aft and a tail which would be fairly conventional were it not for the great size and extraordinary cross-section of the vertical surface, which terminates in a trailing edge almost 2ft thick. Altogether the aircraft is far from beautiful, and it gives little hint of its stupendous performance. In fact, it is designed to be more than twice as fast and fly several times as high as any other aeroplane yet built.

Any vehicle is a compromise in design, and extreme performance can be obtained only at the expense of certain other factors. In the X-15 one limitation is that it has to be carried into the air by a parent aircraft, or by riding pick-a-back on a rocket package. Another is that the payload consists of one human pilot and a little over 1,300 lb of instrumentation. One might well ask why the X-15 has to be built at all, since most of the results which it will obtain could be either simulated in the laboratory or obtained by existing unmanned vehicles. The answer is simple; man has always wished to fly faster and higher, and the X-15 happens to be the vehicle chosen to obtain first-hand knowledge of what conditions are like beyond the atmosphere. It will carry equipment to measure the pilot's reaction on the controls and the effectiveness of these controls; it will measure structural and aerodynamic loads, and the kinetic heating and heat-transfer between components; and, being re-usable, it should provide in a few weeks more information on atmospheric exit and re-entry than could be obtained from a thousand pilotless and expendable missiles.

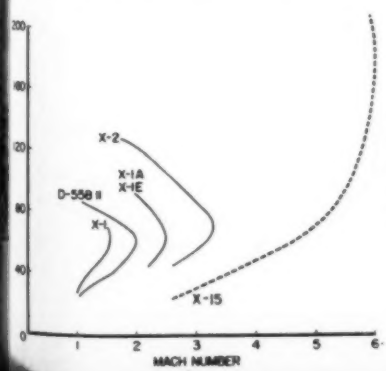
The tables on pp. 642-3 outline the milestones in the development of this remarkable aeroplane and the monetary vote allocated to it. Contrary to what might be expected, the programme is a national effort, managed jointly by the United States National Aeronautics and Space Administration, Air Force and Navy. It was in the spring of 1952 that the National Advisory Committee for Aeronautics (as the N.A.S.A. was then known) directed its laboratories "to study the problems likely to be encountered in flight beyond the atmosphere and recommend methods to explore these problems." After evaluating the suitability of simulated laboratory research, pilotless test vehicles and aeroplanes, the N.A.C.A. decided in favour of an aeroplane.

Basic Design

The diagram below indicates an approximate performance envelope for the X-15, and emphasizes the dramatic increase in speed and altitude capability which this aircraft will achieve. It is therefore a *sine qua non* that its design should pose entirely new problems, particularly in the fields of aerodynamics and control, structures, accessory systems and human factors.

The configuration chosen is surprisingly conventional. The fuselage is a cylinder of oval cross-section. Along either side are disposed large fairings, which suit the aerodynamic profile and body/wing junction and provide accommodation for the numerous fuel, control and instrumentation lines. The stubby wings are sharply tapered and have a modified trapezoidal section. The configuration of the empennage can be seen clearly in the illustrations. Details of the control system are related in a later section.

Propulsion is provided by a single rocket engine, pump-fed with liquid propellants from tankage occupying a major proportion of the fuselage volume. Immediately ahead of the tank bays is the main accessory and instrumentation compartment, and forward of this is the cockpit containing an upward-ejection seat. One of the most striking features of the aircraft is the thick wedge-section vertical tail. This presents reasonable drag at extreme Mach numbers and greatly increases weathercock stability, since at such speeds conventional sections have a low recovery rate following yaw disturbance. At high angles of attack the upper surface is partially blanketed, and accordingly an under-surface is added, the lower rudder being jettisoned before landing. Landing is effected on rear skids and twin nosewheels. The latter are not fitted with either brakes or a steering system owing to the high-temperature environment; for the same reason main wheels could not be employed.



These curves give an approximate indication of the vast increase in speed/altitude capability of the X-15 over some of its experimental predecessors — which were themselves no mean performers

Structure. In the design of the X-15 airframe the most severe problem was posed by the fact that almost the entire aircraft might experience peak skin temperatures as high as 1,000 deg F. In fact, one of the most trying aspects of the environment was the impossibility of predicting the expected temperatures with any high degree of accuracy. A number of types of structure were investigated, some in considerable detail, but in the event the choice fell upon an airframe fabricated from a mixture of stainless steels and titanium beneath an outer skin of Inconel X. Aluminium alloys are restricted to internal applications where the ambient temperatures and stresses permit their use.

Inconel X, produced by the International Nickel Company, has been widely employed in gas turbines and in many other hot and corrosive environments, but its use in an airframe—and on such a scale—is unprecedented. According to the type of heat-treatment and fabrication cycle employed, the alloy can be made to show optimum mechanical properties above 1,100 deg F or below. In the X-15 the greatest stresses should be experienced within the atmosphere at relatively low temperatures, and for this reason the moderate-temperature form of the alloy has been adopted.

Sheet and plate are received by North American after annealing at 1,900/2,000 deg F for 15 to 30 min followed by quenching. International Nickel then suggest stress-equalizing at 1,625 deg F for 24 hr, ageing at 1,300 deg F (N.A.A. retain this temperature for 3 hr) and further stress-relieving at 1,625 deg F for 4 hr. The latter heating has to be extremely rapid to prevent the alloy from becoming age-hardened while in the low-ductility temperature range for age-hardened alloy (1,200 to 1,550 deg F), and this in turn places an upper limit on the material sections which can be employed.

Inconel X is an extremely strong and tough material and it is applied in relatively large sheets. Four are used to make each main tank section and the upper and lower surfaces of the right- and left-hand wings are

initially three slabs welded together edge-to-edge. Special techniques had to be developed, including hot and cold machining, and ovens and freezers capable of taking major airframe sections. Owing to the necessity of maintaining very fine tolerances at all stages, "hard" jigging and tooling has been employed throughout. As an example, one jig which determines the contour of the wing skins during their heat-treatment cycle weighs 4,300 lb, although the finished skins weigh but 180 lb. Most small parts can be heat-treated without retention in jigs, but during water-quenching a considerable amount of warpage was experienced in the early stages of development. Scale-inhibiting material is employed widely.

In sharp contrast to normal practice, some 65 per cent of the airframe joints are welds. Here again very extensive research was necessary before the optimum fabrication procedures could be formulated. As might be expected, the ductility of Inconel X is a function of the hardness, and the latter must not be too high if the welded part is not to crack as a result of weld shrinkage or stresses induced during the welding cycle. Certain sheet parts are deformed to such an extent during their forming that they have to be annealed before being welded, and all bar stock is so treated to reduce its hardness. Since welding must be done before heat-treatment, the size of the heat-treat furnace imposes a limiting factor. For this reason ordinary Inconel (not Inconel X) is employed for the tank-end bulkheads. Inconel, unlike its more sophisticated partner, does not respond to heat-treatment and can be welded after it has gone through the Inconel X heat-treat cycle.

A great deal of flame cutting and chemical milling is employed, since Inconel X is not particularly easy to cut by conventional methods. Particularly noteworthy members are the leading edges of the wings and elevons, since during the re-entry these are expected to get hotter than any other part of the aircraft. Each is milled from a single slab of Inconel X; the final nose radius on the wing is 0.375in and each leading edge is cut into 12in sections to minimize warping.

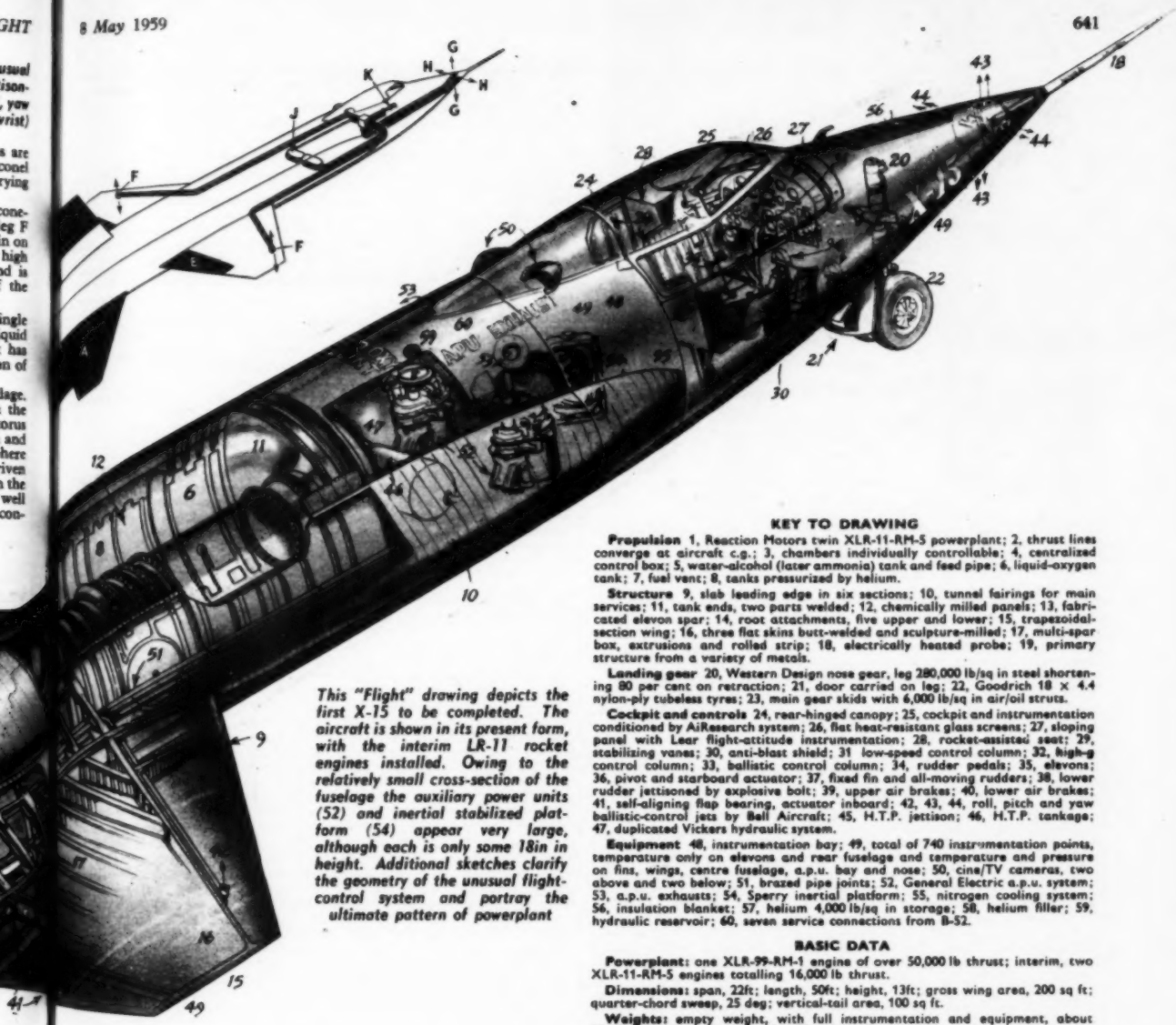
A substantial proportion of the structure is stabilized by corrugations or by welded doubler sheets with parallel fluting. Most spar webs are corrugations, and the tailplane spar is fabricated to form a single Inconel X unit, complete with the root rib and an inboard box section carrying the tailplane pick-up hinges and actuator lugs.

Aerodynamic and jet-reaction controls are disposed in an unusual manner (right). A, elevons; B, upper rudder; C, lower rudder (jettisonable); D, air brakes; E, landing flaps; F, roll jets; G, pitch jets; H, yaw jets; J, control-system H.T.P. tanks; K, pilot controller (left wrist)

The complete aircraft is sprayed with a jet-black paint with a silicone-type base, which will withstand temperatures greater than 1,000 deg F for short periods. Although much thinner than the normal paint skin on a car, the black surface is expected to last for several flights. It has a high radiation rate, to disperse the heat generated during re-entry, and is sprayed on over the oxide formed during the heat-treatment of the Inconel X skin.

Propulsion. In its final form the X-15 will be powered by a single rocket engine with a fixed chamber running on liquid oxygen and liquid anhydrous ammonia. Designated XLR-99-RM-1, this powerplant has been developed for this application by the Reaction Motors Division of Thiokol Chemical Corporation.

Propellants are stored in two large tanks within the fuselage. Unexpectedly these tanks are not integral but are retained within the outer skin by special pick-ups on the ring bulkheads and the main torus rings to which the wing A-frames are attached. Tank pressurization and purging is accomplished by a helium system fed by a 4,000 lb/sq in sphere at the rear of the aircraft. The propellants are fed to a turbopump driven by H.T.P., and at the maximum flow-rate of more than 10,000 lb/min the rated sea-level thrust is "more than 50,000 lb" (implying a thrust well in excess of 60,000 lb *in vacuo*). The LR-99 is designed to be fully controllable from 100 per cent thrust down to 50 per cent.



This "Flight" drawing depicts the first X-15 to be completed. The aircraft is shown in its present form, with the interim LR-11 rocket engines installed. Owing to the relatively small cross-section of the fuselage the auxiliary power units (52) and inertial stabilized platform (54) appear very large, although each is only some 18in in height. Additional sketches clarify the geometry of the unusual flight-control system and portray the ultimate pattern of powerplant

KEY TO DRAWING

Propulsion 1, Reaction Motors twin XLR-11-RM-5 powerplant; 2, thrust lines converge at aircraft c.g.; 3, chambers individually controllable; 4, centralized control box; 5, water-alcohol (later ammonia) tank and feed pipe; 6, liquid-oxygen tank; 7, fuel vent; 8, tanks pressurized by helium.

Structure 9, slab leading edge in six sections; 10, tunnel fairings for main services; 11, tank ends, two parts welded; 12, chemically milled panels; 13, fabricated elevon spar; 14, root attachments, five upper and lower; 15, trapezoidal-section wing; 16, three flat skins butt-welded and sculpture-milled; 17, multi-spar box, extrusions and rolled strip; 18, electrically heated probe; 19, primary structure from a variety of metals.

Landing gear 20, Western Design nose gear, leg 280,000 lb/sq in steel shortening 80 per cent on retraction; 21, door carried on leg; 22, Goodrich 18 × 4.4 nylon-ply tubeless tyres; 23, main gear skids with 6,000 lb/sq in air/oil struts.

Cockpit and controls 24, rear-hinged canopy; 25, cockpit and instrumentation conditioned by AiResearch system; 26, flat heat-resistant glass screens; 27, sloping panel with Lear flight-attitude instrumentation; 28, rocket-assisted seat; 29, stabilizing vanes; 30, anti-blast shield; 31 low-speed control column; 32, high-g control column; 33, ballistic control column; 34, rudder pedals; 35, elevons; 36, pivot and starboard actuator; 37, fixed fin and all-moving rudders; 38, lower rudder jettisoned by explosive bolt; 39, upper air brakes; 40, lower air brakes; 41, self-aligning flap bearing, actuator inboard; 42, 43, 44, roll, pitch and yaw ballistic-control jets by Bell Aircraft; 45, H.T.P. jettison; 46, H.T.P. tankage; 47, duplicated Vickers hydraulic system.

Equipment 48, instrumentation bay; 49, total of 740 instrumentation points, temperature only on elevons and rear fuselage and temperature and pressure on fins, wings, centre fuselage, a.p.u. bay and nose; 50, cine/TV cameras, two above and two below; 51, brazed pipe joints; 52, General Electric a.p.u. system; 53, a.p.u. exhausts; 54, Sperry inertial platform; 55, nitrogen cooling system; 56, insulation blanket; 57, helium 4,000 lb/sq in storage; 58, helium filler; 59, hydraulic reservoir; 60, seven service connections from B-52.

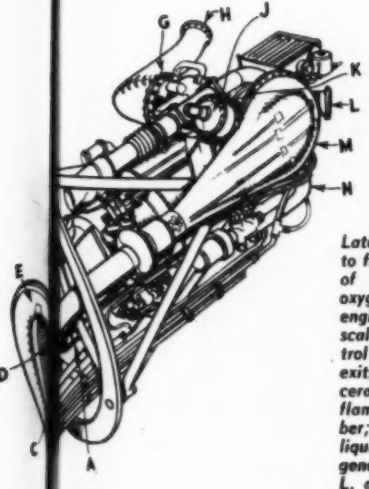
BASIC DATA

Powerplant: one XLR-99-RM-1 engine of over 50,000 lb thrust; interim, two XLR-11-RM-5 engines totalling 16,000 lb thrust.

Dimensions: span, 22ft; length, 50ft; height, 13ft; gross wing area, 200 sq ft; quarter-chord sweep, 25 deg; vertical-tail area, 100 sq ft.

Weights: empty weight, with full instrumentation and equipment, about 16,000 lb; launching weight, 31,275 lb.

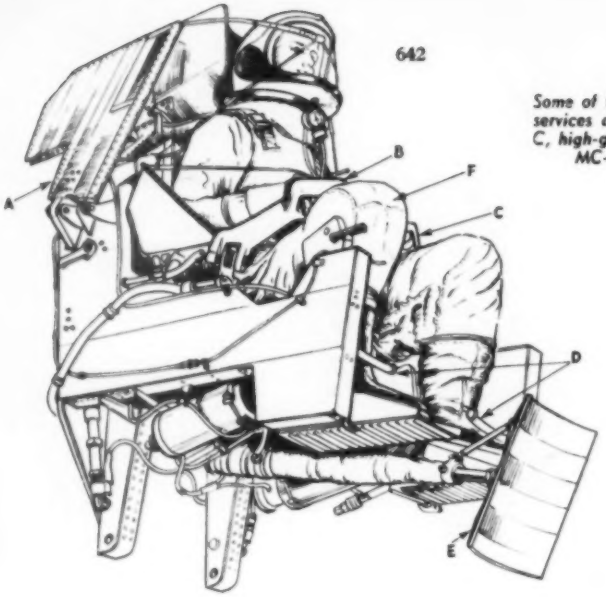
Performance: maximum speed, about 3,600 m.p.h. (M 5.5) at about 180,000ft; maximum altitude, possibly several hundred miles; landing speed, 207 m.p.h. with tanks dry; expected distance to come to rest on dry lake bed, 3,000ft.



Late in 1959 the X-15s will begin to fly on the much increased thrust of the Reaction Motors LR-99 oxygen/ammonia powerplant. This engine is pictured here to the same scale as the main drawing. A, control box; B, discharge and bleed exits; C, turbopump exhaust; D, ceramic-coated nickel tubes; E, flame shield; F, fixed thrust-chamber; G, liquid-oxygen pump; H, liquid-oxygen inlet; J, H.T.P. gas generator; K, ammonia fuel pump; L, ammonia inlet; M, turbine exhaust duct; N, fuel delivery line

It is worth noting that no other rocket engine of this size has been built for the propulsion on a piloted aircraft (in the Western world at least) and comprehensive instrumentation and safety devices are incorporated to prevent malfunction and to permit emergency re-starting in the air. Manual overrides are also provided, in case the pilot should decide that the automatic control system is itself at fault. In conformity with the practice established by Rocketdyne for large unmanned-vehicle engines, the chamber of the LR-99 is fabricated from axially disposed tubes which are brazed together and retained by circumferentially welded bands. While the engine is running ammonia fuel is circulated through these tubes, and the interior of the divergent nozzle is lined with an abrasion-resistant ceramic material. As an accompanying illustration shows, the complete powerplant is bolted to the aircraft through three main vibration-resistant mountings, and the rear flame shield is also attached to the fuselage.

R.M.I. were awarded the propulsion contract in February 1956. Since that date the development of the LR-99 has been one of the Division's most important projects; but, notwithstanding an intensive development effort at Lake Denmark, it has long been appreciated that the engine could not be delivered in time to match the schedule of the aircraft. For this reason R.M.I. have produced an interim powerplant, running on liquid oxygen and water/alcohol, which is currently fitted to the two X-15s so far completed. This interim engine is a double package containing two four-barrel XLR-11-RM-5 motors, each essentially similar to the engines which have long been used in the Bell family of X-1 research aircraft. Use of this powerplant has the advantage of enabling a well-proven propulsion system to be employed during the critical early phases of the flight-test programme. Its chambers cannot be throttled, although



Some of the unusual features of the rocket-boosted ejection seat and the pilot's own services are depicted here. A, stabilizing fins; B, high-g control box (aerodynamic); C, high-g control box (reaction jets); D, leg restrainers; E, anti-blast shield; F, Clark MC-2 suit. This particular seat does not have telescopic stabilizing tubes

CHRONOLOGICAL HISTORY

April 1952: The National Advisory Committee for Aeronautics passed a resolution directing the Committee's laboratories to "initiate studies of problem areas" likely to be encountered during future attempts at space flight.

May 1954: Having previously decided that the optimum course would be the construction of an ad hoc research aircraft, the N.A.C.A. team completed in this month the task of establishing the major design characteristics. The aircraft was to explore aerodynamic heating, stability, control, the physiological problems involved in hypersonic and space flight and, incidentally, the different approaches to the solution of the "hardware" problems (especially of a manufacturing nature).

July 1954: In this month the N.A.C.A., U.S.A.F. and U.S. Navy held a joint meeting to discuss the X-15 programme.

December 1954: Invitations were issued to a selected list of experienced contractors to participate in the design competition.

January 1955: Final specifications were drawn up and formal briefings were held.

May 1955: The interested constructors submitted their bids.

December 1955: The contract was placed with the Los Angeles Division of North American Aviation Inc. and covered research, development and the manufacture of three aircraft.

October 1956: First conference report by Research Airplane Committee.

December 1956: First meeting of the Development Engineering Inspection Board.

September 1957: Construction of the three aircraft started.

July 1958: Mating of major assemblies of the first aircraft and start of installation of equipment. Second conference report by Research Airplane Committee.

October 1958: Roll-out of first aircraft (56-6670) and delivery to flight test.

January 1959: First mating with B-52A at Edwards A.F.B. and start of combined instrumentation.

March 1959: First captive flight.

X-15 . . .

the fact that each can be cut in and out individually does, in fact, give an eight-step incremental variation in thrust.

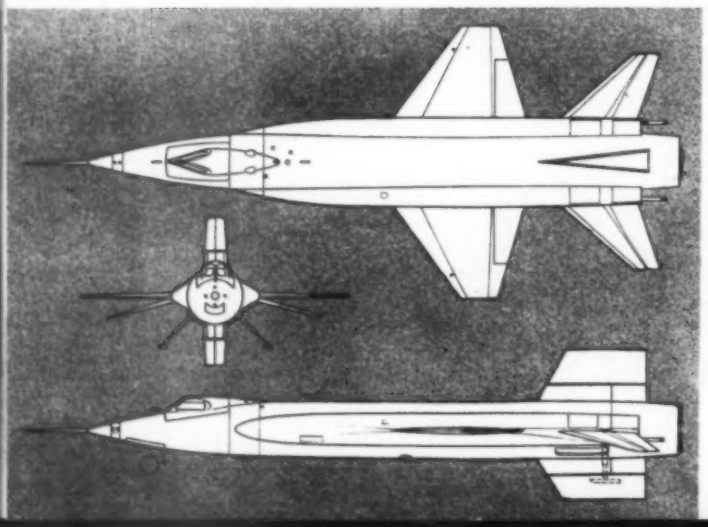
H.T.P. to drive the turbopump is expelled from its tank by a flexible bladder, made from a special fluorinated plastic compound, which is inflated by the aircraft's helium system. Maximum pressure inside the tank is 70 lb/sq in. The peroxide catalyst packs use silver-plated gauze.

Control system. The X-15 is the first aeroplane known in the West in which, owing to its ability to fly in virtually airless space, separate control systems have to be provided for aerodynamic and space flight. Even the aerodynamic controls are of unusual form, dictated by the necessity for manœuvring at Mach numbers as high as 5.5. Within the atmosphere, and at speeds well below the maximum, it is expected that manœuvres may be accomplished at an acceleration of 4g, but the structure is being stressed for 7g—a prudent decision.

Movable surfaces, actuated hydraulically, comprise slab tailplanes (elevons), upper and lower rudders, air brakes and landing flaps. The rudders are provided for yaw control, and the tailplanes move together for control in the pitching plane and differentially to make the aircraft roll (aileron actuators would have projected from the wing and got excessively hot). Unlike the wings they are quite acutely swept, and have anhedral to clear the wing wake.

When the atmosphere is attenuated the weathercock stability of a vehicle approaches zero, and without control the X-15 could re-enter the atmosphere upside down and tail first (for example). For control at extreme altitude the X-15 is provided with a system of miniature H.T.P. rocket nozzles which, switched on and off by pilot demand, impart reaction forces adequate to change the attitude of the aircraft rapidly. For roll control there is a 40 lb nozzle in the upper and lower surface of each wing, and for control in pitch and yaw 100 lb nozzles are disposed around the nose.

No autopilot is fitted. Consequently, although stability dampers are provided on all three axes, the pilot has to fly the X-15 all the way. To perform this task he can utilize three sets of controls. The aerodynamic rudders are operated by conventional pedals. At relatively low speeds and altitudes the elevons are actuated by a conventional control column. At the pilot's right hand is a miniature control column, similarly connected to the aerodynamic elevons for use at extreme speeds and accelerations within the atmosphere. Ballistic control, a regime entered at 120,000ft altitude, is accomplished with a second miniaturized stick on the left-hand console which governs the small reaction jets. The complete system has been extensively investigated during 2,000 simulated hours on a rig and 700 hr in a cockpit installed in the centrifuge at the Naval Air Development Center at Johnsville, Pa.



Outside the atmosphere conventional instrumentation systems based upon static and ram pressure cannot be employed. Accordingly the X-15 carries an inertial navigation system, comprising a Schuler-tuned three-gyro stable platform with three integrating accelerometers, which is continuously aligned with the local vertical. Before release from the parent aircraft the system is fed with information from the B-52's own navigation, height and airspeed systems, so that the X-15's inertial equipment is precisely zeroed at the moment of release. It feeds information on height, rate of change of height, speed, attitude, heading and aircraft position, and contains its own lightweight computer, power supplies and amplifiers. A three-axis flight director attitude indicator provides normal flight information, and angles of attack and yaw.

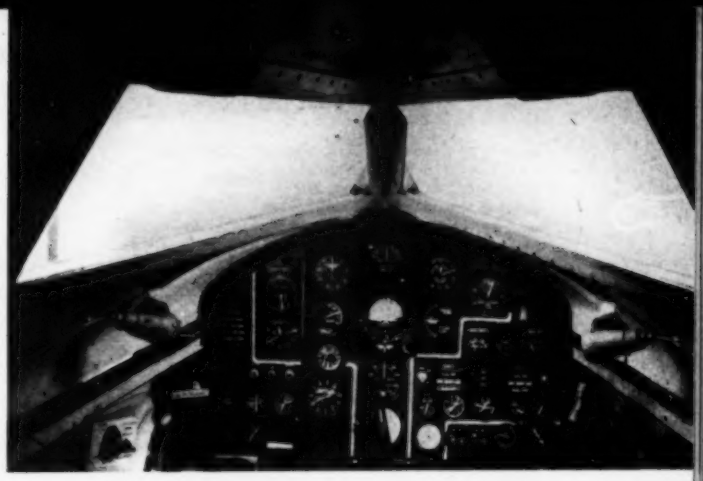
Accessory Power. Although the main propulsion system ceases to function after less than 6 min, the complete mission may last some half-hour and electric and hydraulic power is required throughout. During most of this time the aircraft is not surrounded by usable atmosphere, and in view of the fact that H.T.P. had already been chosen to drive the main engine turbopump it was decided to employ twin a.p.u.s. running on the same fluid—although several other liquids (hydrazine especially) demonstrated lower specific consumption. In each unit the H.T.P. is expanded through a single-stage axial turbine geared to an alternator, and a variable-displacement hydraulic pump. Lubrication is effected by splash augmented by integral centrifugal pumps and an Archimedean screw up the centre of the turbine shaft. Cooling of the gearcase is effected by circulation of the incoming H.T.P. Notwithstanding the fact that the tachometer generator has to operate at the 51,400 r.p.m. of the turbine shaft, a close tolerance control has been developed, capable of holding frequency within 0.5 c/s between 15 h.p. and the no-load condition.

Both a.p.u.s. are coupled to duplicated aircraft power systems. Hydraulic actuation is used for the main control system, speed brakes and landing flaps; the undercarriage and skids fall by gravity and air load. System pressure is 3,000 lb/sq in and among the problems which had to be faced in its design were the necessity of employing a new fluid capable of operation between about 1,000 deg F and a temperature well below freezing point, together with O-rings with similar temperature limits and the necessity of evolving a cleaning process capable of getting all parts of the system surgically clean before anything was put in them. Virtually all pipe-joints are brazed. The main electric system operates at 115 V, 400 c/s, the output from each a.p.u. being 4 kVA and the maximum system temperature being 200 deg F (although N.A.A. are currently working on 600 deg F systems for the B-70 and F-108).

Pilot Environment. Although it has been said that flying the X-15 should be "no more dangerous than the first flight of any new high-performance airplane," the fact remains that it is going to expose pilots to a new environment. For this reason every possible precaution has been taken to ensure their safety and comfort. The arrangement adopted is surprisingly conventional; the pilot wears a full-pressure suit and helmet and sits in an upward-ejecting seat in a pressurized cockpit, there being no escape capsule of any kind.

The cockpit is pressurized and air-conditioned by a liquid-nitrogen system. The cold fluid is expelled in the liquid and gaseous states to ensure that all critical items are kept within the prescribed limits of temperature. Total weight of the cooling system is 150 lb and its rated capacity 27,000 B.T.U./hr.

Over 60 "vital statistics" are needed in order to match the pressure suit to the pilot concerned. The garment is intended to provide complete protection, even following catastrophic loss of cabin pressure, and is served by eight air bottles discharging at a controlled rate, the dumped



Of surprisingly conventional appearance, the panel contains Lear and Sperry instruments specially developed for the aircraft

air being used to carry away body-generated heat. It is also, of course, plugged into a breathing oxygen system served by a liquid-oxygen converter. The outermost of the five layers of the suit is aluminized to provide a heat-reflecting surface, and the fabric is stressed to withstand the supersonic airflow during an emergency ejection. It is intended that the suit shall provide complete protection in the event of loss of cabin pressure.

In the event of serious trouble at high altitude the pilot would try to ride the aircraft down during the re-entry. The seat is ejected by a conventional cartridge system supplemented by a downward-firing rocket. A flat plate carried ahead of the seat provides a bluff body which generates a strong normal shock-wave, through which the pilot's head should never project. Seat-stabilization is achieved by hinged fins and telescopic bars. Following initial deceleration, separation of the pilot from the seat and deployment of his parachute is controlled by a barometric system. Flight testing of many of the X-15 pilot services and the seat has been conducted with a specially instrumented TF-102.

The Current Programme. Of the three aircraft involved, the first was delivered to the N.A.A. Flight Test Department in October 1958 and the second in March of this year; the third is also practically complete. Last year seven pilots were named to fly the X-15. North American Aviation has assigned as project pilots A. Scott Crossfield and Alvin S. White; the Air Force has chosen Captains Robert M. White and A. Rushworth; and the N.A.S.A. has selected Joseph A. Walker, John B. McKay and Neil A. Armstrong. All are experienced engineer/test pilots. Their task will be divided into clear sections; in 20 missions the contractor's pilots will demonstrate structural integrity and satisfactory performance of the propulsion and control systems up to M 2 and 100,000ft; the Air Force will formally accept the aircraft and turn it over to the N.A.S.A. for a joint research programme.

All X-15 operations during the foreseeable future will be conducted with an aircraft launched at 38,000ft by a B-52A operating from Edwards A.F.B., Cal. An accompanying diagram outlines the two main types of mission which can be flown over the instrumented High Range which runs 485 miles from Wendover A.F.B. across the salt flats and deserts of Utah, Nevada and California to Edwards. N.A.A.'s house magazine says, "The radar will pick up an airplane 400 miles away and bring back the image to plot visually on a chart and as a code on tape, as well as in 'English,' its position in terms of actual yards away in space, its altitude and its speed. Telemetry equipment capable of picking up information from an airplane 160 miles distant will pile mountains of data into control rooms." The course itself is described as "50 miles wide and as high as the fringe of space." During free flight more than 1,000 questions will be asked electronically from one to ten times every second (i.e., per mile). Of these 1,000 questions 656 will concern temperatures, 104 strains, 140 pressures and 16 control positions, and the remainder of the telemetered data will comprise such items as the pilot's body temperatures and heart action. Three engineers on the ground will literally look over the pilot's shoulder, and check on such items as the pressures in the tank bays and within the rocket feed system.

Originally it was hoped that a powered flight would be made in February, but in the event the first captive flight did not take place until March 19. Extensive rig and vibration testing had to be done at Edwards with the first X-15 attached to the B-52. High surface winds at this time made the actual attachment no easy task and eventually hydraulic dampers were jacked-up under the B-52's outrigger wheels to minimize the swaying of the big bomber. The B-52 is packed with instrumentation and special systems capable of servicing the X-15's needs up to the moment of release. The aircraft is suspended from a pylon mounted well inboard beneath the B-52's starboard wing, the latter having a large notch cut from the trailing edge to admit the upper rudder of the X-15. Through the pylon pass lines which feed the X-15 with H.T.P., liquid oxygen (the tank must be topped up to preserve the correct c.g. position), nitrogen, hot and cold air, breathing oxygen and electrical power.

Once secured to the parent aircraft, the X-15 is fully serviced, the nose undercarriage and skids are retracted and the lower rudder added. The pilot is then sealed in his cockpit and must remain there throughout the mission of some 2½ hr. Take-off of the B-52 starts with engines 5 and 6 throttled back to minimize noise impingement on the X-15's tail.

As already noted, the first flight of the X-15, with empty tanks took place on March 19. It was marred by minor failures in the electrical and communications systems, and some difficulty was also experienced with the main electrical power lines leading from the parent aircraft. One item satisfactorily completed was the determination of the spray pattern from the X-15's fuel and H.T.P. jettison nozzles, using coloured dyes. On the second flight communications were again lost, and the third trip was marred by troubles with the a.p.u.s. At the time of writing the X-15 is almost ready for its first separation and glide; launched at 38,000ft at 270 kt I.A.S. (420 m.p.h. true) the X-15 will sink at 150 ft/sec and must complete a "seat of the pants" arrival at Edwards in little over two minutes. The landing pattern is illustrated below.

The first powered flight is scheduled for next month. All drops will be made with full tanks and all landings will be dry. With the present interim engine the X-15 will not achieve its full design performance, but should nevertheless reach speeds and altitudes in the neighbourhood of 3,000 m.p.h. and 50 miles (not simultaneously). With the ultimate engine it has been suggested that the X-15 could climb vertically to "several hundred miles" altitude and with additional rocket boosting it could undoubtedly be placed in orbit. But, in American parlance, this is "a little way down the road."

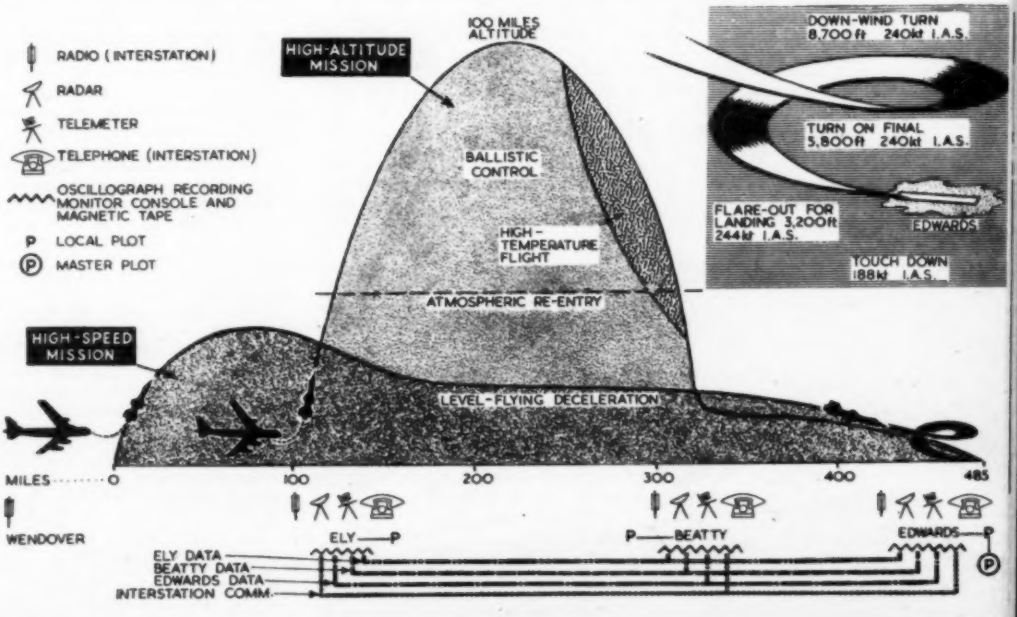
W.T.G.

THE COST

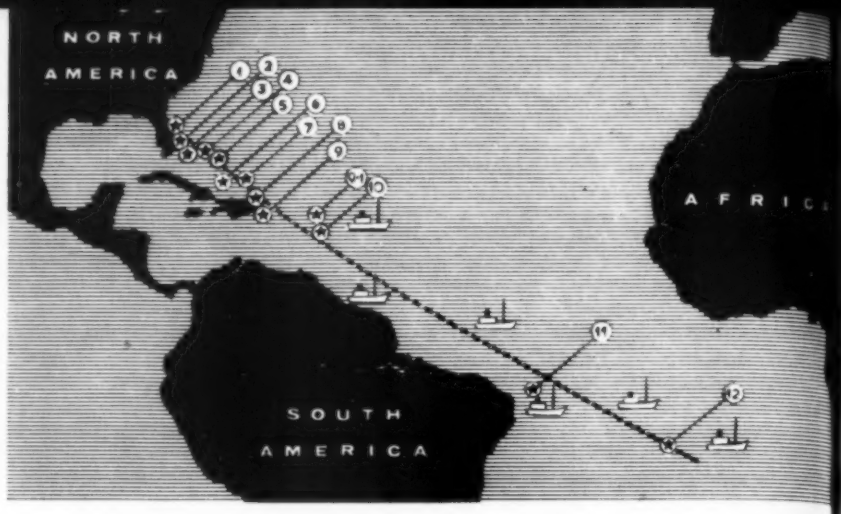
The United States Fiscal year runs from July 1 to June 30. The direct contract costs have been borne entirely by the armed Services, as shown in the table. These figures cover the contracts placed up to and including the completion of the third X-15; the units are millions of dollars:—

	FY 56	FY 57	FY 58	FY 59	FY 60	Totals
U.S.Air Force ...	8.8	18.3	39.1	36.3	13.6	116.1
U.S.Navy	0.5	1.8	2.1	1.0	0	5.4
Totals	9.3	20.1	41.2	37.3	13.6	121.5

Not included in the above are the substantial indirect costs involved in laboratory and tunnel testing, chiefly by the A.R.D.C. and N.A.S.A. The latter body has not met direct costs but has supported X-15 research from its own operating budget.



This diagram, prepared from an original by North American Aviation, depicts typical high-speed and high-altitude missions over the N.A.S.A./U.S.A.F. High Range. Information depicted includes radar and telemetry recording, the flight-safety monitor console and U.H.F. air/ground communications. The inset depicts the landing pattern, which is entered at 15,200ft at 240 kt I.A.S.



The Atlantic Missile Range covers over 5,000 miles. The stations are (1) Cape Canaveral, (2) Jupiter, Florida, (3) Grand Bahama, (4) Eleuthera, (5) San Salvador, (6) Mayaguana, (7) Grand Turk, (8) Dominican Rep., (9) Mayaguez, (9.1) Antigua, (10) St. Lucia, (11) Fern. de Noronha, (12) Ascension

4.—CAPE CANAVERAL AND AIR RESEARCH AND DEVELOPMENT COMMAND

U.S. Missile Tour

BY KENNETH OWEN

A PUFF of grey smoke blotted out the slender umbilical tower and the missile bored upwards, almost vertically upwards, thrusting a brief yellow triangle behind it, like a roaring flame-tailed arrow from an invisible bow. Faster and straighter, it seemed, than the Thor and Thor-Hustler heavyweights we had seen fired at Vandenberg, this Polaris test vehicle was really getting up and out in a hurry from Cape Canaveral.

This was the April 20 launch (reported and illustrated last week) with which our tour of Cape Canaveral began. We had watched it from the top of the concrete terminal room adjoining launching complex 17A, in the massive launch tower of which a Thor first stage was being groomed and checked prior to the attachment of its second stage and payload. The gantry, the central one in a trio of Thor launch sites, carried a 20-ft extension on top to accommodate the "exotic" Thor-based vehicles used for space research.

Major H. A. Myers of the Air Force Ballistic Missile Division showed us around the Thor launching site. Of the three pads, 17A and 17B are controlled from one blockhouse, while 18B shares a second blockhouse with the NASA Vanguard tower. Pads 17A and 17B are equipped with water-cooled flame-deflector plates and water channels, and can accept full static firings, while the third pad has a flat concrete base and is not used for static firing. Permanent facilities surrounding the launching tower itself include fuel and oxidiser storage tanks, high-pressure air storage, and camera and instrumentation facilities. In addition to the launch site there are two Thor hangars in the industrial area in which the missiles are initially checked out on arrival at the Cape by road from Patrick A.F.B.

Located about 200ft from the the launching platforms, the Thor blockhouse resembles a shallow concrete dome embedded in the ground. Inside the 12ft-thick shell is installed what amounts to a compact and self-contained electronic laboratory. Banks of racks carry communications and recording equipment and other instrumentation, while nearer the two green concussion-proof glass windows (through which the view of the pad is periscopic) are the control and checkout consoles and the countdown desk. Many of the countdown operations which would be automatic in the case of an operational Thor are here performed manually—a reflection of the research and development attitude which, illustrated also in long preparation times and the emphasis on efficient telemetry of measured data rather than on a straightforward, full-range firing, is characteristic of the Air Force Missile Test Center.

Fifteen painted rockets on the outside wall of the terminal room at Complex 17A indicated some of the shots which had been logged from this pad. Another Thor-Able shot of some kind was expected soon at the time of our visit (and may well have taken place by the time this is published), and a standard Thor was due to be fired that night from 17B as part of the continuing programme of flight-testing the missile's operational capability. Postponed because of bad weather that night, this shot was a success on April 23 when, after a 1,500-mile flight, the ablative nose-cone and the instrument capsule which it contained were recovered after re-entering the atmosphere and falling into the Atlantic. This was stated to be the fourth capsule to have been recovered from Thor nose-cones.

To the north of the Cape Canaveral lighthouse are the ICBM pads. Numbers 11, 12, 13, and 14 are for Atlas, each with its own blockhouse, and the operation of a typical complex, No. 14, was shown and described to us by the resident Convair manager and Capt. R. E. Rae of A.F.B.M.D.

The distance from launch tower to blockhouse is 750ft in the case of the ICBM installations. Thickness of the concrete blockhouse shell varies from 5ft to 22ft and the building is mounted on a "floating" base to absorb shock. The spacious, well-planned interior of blockhouse 14 contains four television screens and four periscopes for viewing the launching area. Zoom lenses are fitted to the television cameras, which are operated from the control console.

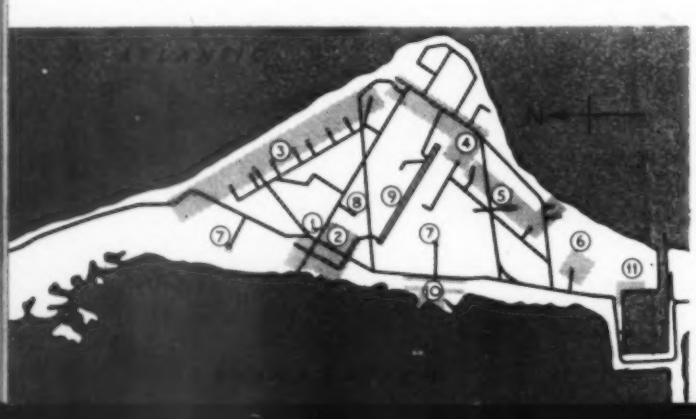
A test of the liquid oxygen dumping system was in progress at the time of our visit. Green lights on the test conductor's panel indicated that all the systems engineers' checks had been completed. The launch sequence, once started, is here completely automatic. Early Atlas launches had each been preceded by static firings, we learned, but confidence in the missile had now reached the stage where only the first of each new series was statically fired at the Cape prior to launching.

The Convair representative told us that a total of 23 Atlas missiles had been fired to date. In the launching gantry across from the blockhouse was Atlas 7D, the seventh "interim operational" weapon off the San Diego production line. The range achieved on the various Atlas firings from Canaveral depended primarily on the weight of instrumentation carried and on the purpose of the individual firings—whether a shallow trajectory giving a long re-entry period was desired, or a steep trajectory with a rapid re-entry.

Leading up to the tall Atlas gantry is a concrete ramp, along which the missile is carried in its special trailer (both missile and trailer are raised together into the vertical position in the gantry). A wheeled transfer table is used to move the gantry away from the missile prior to launch, leaving in position an umbilical tower carrying servicing connections. On the opposite side of the gantry to the ramp is the water channel from the flame deflector, and the tower is flanked by tanks for liquid oxygen and fuel respectively.

The SM-68 Titan ICBM was the subject of our final call at Cape Canaveral. Outside the entrance to Complex 19 (one of four Titan pads) a notice on a mobile office of the Martin Company proclaimed "MARTIN. COCOA. COMPLEX ACTIVATIONS" (unfortunately without an English translation for the final phrase).

Erectors rather than gantries are used for this type of missile, as indicated in the photograph in last week's instalment, and each launch installation comprises side-by-side erectors for the second stage and the complete two-stage missile respectively. The main umbilical tower carries four working platforms and booms from



Layout of the Cape Canaveral launch area: (1) central control, (2) industrial area, (3) ICBM launch area, (4) light missile launch area, (5) IRBM launch area, (6) transmitter area, (7) receiver area, (8) guidance area, (9) skid strip, (10) fuel storage, (11) harbour facilities

The 35,000ft captive missile test track at the A.R.D.C. Air Force Missile Development Center, Holloman A.F.B., New Mexico, was officially opened on February 25 this year

which cable connections are made to the missile, and the main erector has seven working platforms. Around the launch stand are storage tanks and emergency dump pits for fuel and liquid oxygen, a theodolite hut, air conditioning equipment and television camera positions. A shallow ramp and two exhaust water channels lead to and from the pad on opposite sides, and a tunnel carries instrumentation cabling to the blockhouse, which is about the same distance away as for the Atlas sites.

The Titan blockhouse is a two-floor structure which we entered through a thick steel door on the lower level. Coloured protective helmets labelled JONES, JIM, etc., hung on racks near the entrance. Upstairs in the control room the layout seemed even more spacious than that for Atlas; half of the equipment comprised the operational launch control system, and the remainder covered research and development.

The control room is served by six closed-circuit television cameras and four periscopes, and the test conductor's control console is surrounded by unit consoles concerned with pneumatics, liquid oxygen, fuel and other operating functions. The rear of the control room is filled with racks of electronic equipment. The entire blockhouse is enclosed by a concrete-and-sand sandwich up to 28ft thick, and there are two emergency tunnel exits.

Three Titan test vehicles had been fired at the time of our visit—on February 6, February 25 and April 3 this year. The object of these tests had been "to evaluate the compatibility of the airframe, first stage propulsion and the control system" (in each case the missile had incorporated a dummy second stage filled with water), and each firing was successful. As is the case with Thor and Atlas, every Titan flown is a production-line missile.

The Air Force Missile Test Center at Patrick A.F.B. and at Cape Canaveral (the overall organization of which was described last week) is a unit of Air Research and Development Command, whose headquarters are located at Andrews A.F.B., near Washington, D.C. Calling in at Andrews on **Friday, April 24** prior to our departure for "Orly Field, Paris, France" and Northolt, we were able to learn something of the overall work of A.R.D.C., the command of which is shortly to change from Maj-Gen. John W. Sessums, Jr., to Maj-Gen. Bernard A. Schriever.

The broad responsibility of A.R.D.C. is to maintain the qualitative superiority of U.S.A.F. air weapons. In addition to its headquarters the Command has 12 sub-commands or centres throughout the U.S.A., 23 technical liaison officers and a European office in Brussels. Among its major U.S. centres are the Air Force Ballistic Missile Division at Inglewood, California (**Flight**, April 17), and the following bases.

Flight testing of aircraft powerplants and components and static firing of missile powerplants is performed at the Air Force Flight Test Center at Edwards A.F.B., California. Probably the best known of all A.R.D.C. Centers, this base is located in the Mojave Desert, and makes use of the natural runway 13 miles long and 5 miles wide formed by Muroc dry lake. The Air Force Special Weapons Center at Kirtland A.F.B., New Mexico, works closely with the Atomic Energy Commission and the Armed Forces Special Weapons Project at the nearby Sandia base in the development and testing of nuclear and thermonuclear weapons. Aircraft from the 4926th Test Squadron (Atomic) based at Kirtland fly through nuclear clouds as early as 15 minutes after detonation, in order to gather radiation samples.

Ground electronic components of all types are developed and tested at the Rome Air Development Center at Griffiss A.F.B., New York. At Boston, Massachusetts, the Air Force Cambridge Research Center is responsible for research and technical development over a wide field in electronics and geophysics, co-operating closely with the Massachusetts Institute of Technology and the Lincoln Laboratories on air defence warning systems.

Wind tunnels and high-altitude test cells at the Arnold Engineering Development Center at Tullahoma, Tennessee, are used for testing and evaluation of aircraft, missiles, aerodynamic components and propulsion systems. At Eglin A.F.B. near Pensacola, Florida, is located the Air Proving Ground Center, which utilizes a range area of 800 square miles over the mainland and the Gulf of Mexico. Used for testing of aircraft armament systems, these ranges have also been employed for the evaluation of the Bomarc missile. Among the facilities of the Center is a climatic hangar in which components and aircraft can be tested at temperatures from −65 deg F to +165 deg.

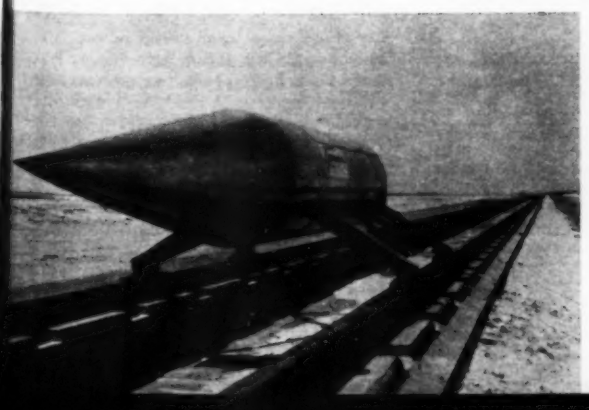
The Wright Air Development Center at Dayton, Ohio, is one of the world's most extensive and completely equipped facilities devoted to aeronautical development. Propulsion, aerodynamics, navigation and aviation medicine are included in the wide range of its subjects of research. Recent tests at the Aero Medical Laboratory at this Center have been concerned with the physical and psychological problems of weightlessness. The final establishment in this list of research and test centres, and one that is illustrated on this page, is the Air Force Missile Development Center at Holloman A.F.B., New Mexico. Together with the Army White Sands proving ground to the south, a range 100 miles long and 40 miles wide is provided in which are sited test facilities and tracking instrumentation for short-range missiles. The Center also carries out research in geophysics, electronics and aviation medicine, and its seven-mile supersonic track forms a valuable facility in testing advanced ballistic missile components such as ICBM nose-cones.

This, then, was the end of our U.S.A.F. missile tour. We had seen component parts of the Thor IRBM being manufactured and tested, final assembly at Douglas Santa Monica, and the first Thor launch by an R.A.F. crew. We had visited R.A.F. specialists training in the many aspects of operating the missile, and had obtained an idea of the great effort that had produced a virtually operational IRBM in only three years.

From the U.S.A.F. Ballistic Missile Division and Strategic Air Command we had learned how Thor and the other U.S. missiles fit into the overall picture of the U.S. strategy of deterrence. We had visited Cape Canaveral, a name synonymous with space research, and had seen Discoverer 2 launched from the west coast. By way of an incidental bonus there was the World Congress of Flight and (to put it mildly) there was Las Vegas.

Transport during this 8,500-mile tour had been by a Convair C-131D of the 1254th Air Transport Group (Special Missions) of Military Air Transport Service, commanded impeccably by Capt. Clark E. Farrar with Capt. Jack Batty as co-pilot. The unenviable job of escorting the Press group was handled efficiently by Maj. William James of U.S.A.F. Headquarters, Washington, Lt-Col. Robert Wilson of the Third Air Force, South Ruislip, and Maj. John Laurie of the Seventh Air Division, S.A.C.

By the end of the trip we were no longer surprised at the sight of a five-stage neon rocket firing outside our motel—this, needless to say, was at Cocoa Beach, near Cape Canaveral. Neither were we surprised to find "lox on the rocks" on the restaurant cocktail list. As for serious missile information it is pleasant (if immodest) to record that the 1958 Missiles issue of *Flight* was praised as a source of reference by many of the missile specialists we met—and was carried and used for reference during the tour by the representatives of more than one journal.



One of the fastest sleds used on the new track at Holloman, this device can carry a 200 lb payload at speeds approaching Mach 4

Straight and Level

THE discussion of a lecture is often more illuminating than the lecture itself. Sometimes, of course, a ghastly silence greets the invitation to ask questions—though even this is illuminating.

In general, however, the discussion discloses two things: (1) The real character of the lecturer, who cannot very well answer questions from notes prepared by his P.R.O. (2) The mood and feeling of aviation's Ordinary Worried Blokes in the audience.

What do recent discussions disclose of the present thoughts of these O.W.B.s? Take, for example, the most recent series of lectures. One, by Mr. Donald W. Douglas, Jnr., at the R.Ae.S., was about the American aircraft industry. The others—at Southampton before the Institution of Production Engineers—were about the British aircraft industry.

Scarcely one of the many questions asked by O.W.Bs. at these lectures concerned anything except air transport.

● I think that this, from the *B.E.A. Magazine*, deserves a hear-hear:—

"At a special party at Grosvenor House on March 19 Lord Douglas had his '10-year Badge' pinned on him by Anthony Milward, chief executive. Members of the board of B.E.A. and heads of departments present at the reception revealed the fact that almost all of them had spent at least ten years with the Corporation. Deputy chairman Sir John Keeling, Mr. Milward, commercial director P. C. F. Lawton, flight ops. director Captain Jimmy James, financial director Lorimer Weir, traffic director Edwin Whitfield, and board member Sir Patrick Dollan—all have 13 years service apiece, and Messrs. Beverley, Shenstone, chief engineer, Henry Marking, secretary, and board member A. C. Ping have each completed a decade. . . .

"There is little doubt that this fine record of uninterrupted management, in these days of continual Civil Service changes, has contributed immensely to the remarkable development of B.E.A. which, almost uniquely, has succeeded in becoming a great and successful Corporation but still . . . remains a 'family' firm."

● In Washington on April 22 Mr. H. A. Wassenbergh, the deputy chief of K.L.M.'s foreign relations department, was reported by Reuter to have spoken of "the long-standing refusal of the United Kingdom to allow American airliners to land in Hong Kong."

Since I am as touchy as every other Briton on this issue, might I remind Mr. Wassenbergh that Pan American have had rights at Hong Kong, *which they link with Tokyo*, since 1947?

Much more worthy of the Dutch was the recent newspaper cartoon depicting a very British couple, obviously in Singapore, being served tiffin by a Malay servant. The caption read:—

"Can't we kick them out of Schiphol too, dear?"

● Mr. D. P. Davies, chief pilot of the A.R.B., chatting to two of my colleagues at a reception in London:—

"We flew some pre-war aeroplanes again recently and we were pretty horrified at the way they behaved. Of course, you can get used to anything, but I wouldn't pass them out now.

"You just don't realize how straightforward large modern aeroplanes are to fly. A Britannia, a Viscount or a Comet work just like the book. I'd say that a pupil pilot—given sufficient courage—could manage a successful circuit and landing in a Comet. Certainly he would need less delicacy of touch and real flying ability than I found necessary to put a Proctor down in a crosswind . . ."

Venus. Deification of beauty and love. Brightest star of the firmament. The astronaut's target for tomorrow—to study whose vital statistics M. Audouin Dollfuss recently had himself borne aloft by 104 balloons. He landed (hapless wight) in a field of cows. But if you saw the Glynis Johns film you will remember that Venus was a very beautiful cow indeed. I am not sure, though, that it was altogether seemly for M. Dollfuss to wear his hearts quite so overtly on his sleeve

INVALIDS

The condition of Sir Charles Boost, who was taken ill after reading the report of the Supersonic Air Transport Committee, is said to be "as satisfactory as can be expected." A spokesman for the Imperial British Airmen's Hospital says: "Sir Charles was badly shocked, and has been advised by his doctors to rest."

● Most Service aircrew nowadays carry knives on their sleeves to stab a dinghy or lifejacket if it should inflate at the wrong moment in the air. Such a practice has only relatively recently become *de rigueur* although the threat has always existed and several lives have been lost because of it. A colleague was told by a wily flying instructor always to fly with something like a sharpened screwdriver to use variously for stabbing, prodding or even screwdriving, as the emergency might demand. Because a lounge-suit does not take kindly to screwdrivers and civil aircraft are generally demanding, he now carries an ordinary nail file (Woolworth's, 4d).

While touring France recently in *Flight's* Gemini, he had occasion to screw up a cowling panel which was loose and then had to remove two plugs which had oiled up. All but the actual removal of the plugs he accomplished with his nail-file. During almost 15 hours' flying over more than 1,600 nautical miles he had only one other job to do—unfastening the oil-tank filler covers. He used the nail-file for that one, too.

This is the sort of reliability and accessibility I like to see. But on some American aircraft you don't need any tools at all to check, drain or refill the oil sump—and certainly none to remove the cowlings. But you still need something to take a stab at your lifejacket.

● Looking through lists of U.S. Air Force contracts I frequently come across the item "Blue Streak and emergency spare parts"—generally awarded to Douglas Aircraft. I hardly think that this has any bearing on our own long-range ballistic missile of that name, but now I find that the Sperry Gyroscope Co., at their main plant at Great Neck, Long Island, have just received a $332,896 award involving Project Black Knight. Would the Minister make a statement?

● Did you see in *Flight* recently that fascinating photograph of B.O.A.C.'s London Airport headquarters? It was taken from nine miles up, and you could almost read the numbers on the aeroplanes.

One thing in particular fascinated me—the emptiness of the visitors' car park. Never once have I or any *Flight* colleague ever found even one empty space on our regular visits. My statistical adviser calculates that, from recent counts of the cars in all the parks, each B.O.A.C. staff-member has three visitors each day.

Assuming, of course, that all the cars in the visitors' car park belong to visitors.

ROGER BACON

SERVICE AVIATION

Royal Air Forces and Naval Flying News

Back to Coastal

HAVING served with Coastal Command in the early years of the war, when he was O.C. No. 217 Sqn., A.V-M. L. W. C. Bower has now returned to the Command as A.O.C. No. 19 Group. Before taking up this new post last Friday he was S.A.S.O. at M.E.A.F. from March 1957, and prior to that held a similar appointment with Fighter Command. His later wartime service was on fighter aircraft, when he commanded No. 138 Wing, a Mosquito Wing of No. 2 Group. He was awarded the D.F.C. in February 1944 and the D.S.O. in June 1945, and was twice mentioned in despatches.

Showing the Shackleton

AN Avro Shackleton M.R.3 of No. 201 Sqn., Coastal Command, is due to take off from R.A.F. St. Mawgan today on a round-the-world tour during which the aircraft and its equipment will be demonstrated to the maritime staffs of six different countries. The aircraft, captained by W/C. J. Roberts and with two representatives of the Joint Anti-Submarine School aboard, is visiting India, Singapore, Australia, New Zealand, the U.S.A. and Canada. The whole trip, lasting 41 days, will cover 27,850 s.m. The total flying time is estimated as 134 hr 50 min.

Bomber Command Changes

CHANGES in senior Bomber Command posts have been announced by Air Ministry. From today (May 8) A.V-M. T. A. B. Parselle is to be Senior Air Staff Officer at headquarters; and his predecessor as S.A.S.O., A.V-M. J. G. Davis, is to be A.O.C. No. 1 Group from June 14.

A.V-M. Parselle has commanded Task Force "Grapple" since October last year and previously was A.O.C. and Commandant of the R.A.F. College at Cranwell. One of his wartime appointments was the command of No. 207 Sqn., until during an attack on Dusseldorf in May 1943 his Lancaster was shot down and he was made P.O.W. A.V-M. Davis has been S.A.S.O. at Bomber Command since June last year and for three years previously had been Director of Plans at Air Ministry. Much of his war service was with Coastal Command, one of his posts being that of O.C. No. 269 Sqn.

Swift Success

ONE of the two Swift squadrons, No 79, competing for the first time in the Sassoon Challenge Cup aerial photography competition has won the trophy this year. A Canberra squadron, No 17, was second and No. 2 Sqn. (Swifts) came third.

The cup was presented to the R.A.F. in 1932 for competition by the then Under-Secretary of State for Air, the late Sir Philip Sassoon. It was offered to 2nd T.A.F. (now R.A.F. Germany) for a trial period three years ago, and Air Ministry has decided that the Command may retain the trophy as long as three squadrons compete for it. The two previous competitions were restricted to high-level vertical photography and because of bad weather lasted for several weeks. This year, the contest was based on the Command's concept of low-level P.R.—the Swifts being hot favourites because of their experience in this type of work—and was held in one day.

H.M.S. "Eagle" steaming into wind during the visit to her by the Queen and Prince Charles on April 29. Sea Hawks of No. 806 ("Ace of Diamonds") Sqn. can be seen, and beyond them the Skyraiders of No. 849A Flight and Gannets of No. 814 Sqn.

Fair-weather Gathering?

ON Friday, May 29, at 7 p.m. the annual reunion dinner of No. 264 FAW Sqn. is being held at the Gore Hotel, Queens Gate, London, S.W.7. Details may be obtained from Mr. K. M. Webster, 103 Long Lane, Stanwell, Staines, Middx.

Steel-centred Structure

WITH a distinguished company of guests and with the royal variety of six courses (to emphasize the warmth and width of Northern hospitality), the annual dinner of Manchester University Air Squadron on April 30 had all the ingredients of a successful occasion; and as in addition the principal R.A.F. guest (A.V-M. D. M. T. MacDonald, Director-General of Manning) made one of the most interesting speeches one has heard from a senior officer at such a function, the commanding officer (S/L. S. A. Harris) could reckon that his first Manchester U.A.S. dinner as C.O. was indeed a success.

The other senior R.A.F. guest was A.V-M. C. Scragg, A.O.C. No. 23 Group of Flying Training Command, which now keeps an eye on the university squadrons following the demise of Home Command. Representing the city of Manchester was its Lord Mayor, Ald. J. Fitzsimons; and representing the university its vice-chancellor, Prof. W. Mansfield Cooper, who in responding to the toast of "The university and our guests" wished the squadron God-speed in all its doings.

S/L. Harris, who had proposed this toast, made particular reference to Mr. F. A. Chapman of Short Brothers & Harland Ltd. who are responsible for the servicing of Manchester U.A.S. aircraft at Woodvale; and he spoke of the squadron's pride in retaining the de Havilland Trophy for the third year in succession.

The C.O. went on to say that eight members had joined the R.A.F. during the past twelve months; and when A.V-M. MacDonald came to propose a toast to "The Squadron" he made a special point of mentioning the high regard which the Royal Air Force has for the universities and the importance the Air Council attaches to their squadrons. "The R.A.F.," he said, "must have a continual connection with the seats of higher learning." For much of his speech A.V-M. MacDonald put away his notes and spoke quite informally from his own experience as a senior officer with special concern for manning of the needs of the R.A.F., giving an instructive view of service life and the type of officer required. He stressed that the way was open for anyone with character and brains "to go to the very top"; and he cited the examples of the C-in-C.-designate of Transport Command and the S.A.S.O. of Bomber Command as ex-university men who had done so. Employing an angling metaphor, he likened the R.A.F. structure to a fishing-rod with a steel centre; but, he said, "we must have short-, medium- and long-service types"—with the cadet entry as the steel centre.

It fell to P/O. T. R. G. Sear to thank A.V-M. MacDonald, which he did appropriately with the addition of some friendly digs at squadron members; and the formal part of the evening was fittingly rounded-off by the award of two trophies. This presentation was made by A.V-M. Scragg, the Cheshire Trophy (for the best all-round cadet of the year) going to Cdt. Plt. Stuart Deane and the Campbell Trophy (for aerobatics) to P/O. Ian Nicoll. H.W.

Argyllshire NATO base

IT was confirmed by the Admiralty last week that plans to develop Machrihanish airfield, Argyllshire, as a NATO air-base are under way. Main features of the development will be an extension of the east-west runway, construction of a jetty for use by aircraft carriers and the building of a four-mile road between the airfield and the jetty. The latter will be on the south shore of Cambeltown Loch and the road is to skirt Cambeltown.

Machrihanish was a Naval air station during the war and is now on a care-and-maintenance basis, administered by R.N. personnel.

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

Supersonic Airliners

ALTHOUGH I have not lived in Britain for over ten years I very much enjoy following the activities of the British aircraft industry through *Flight*. I would like to make a few comments on your editorial in the March 27 issue entitled "The Hot Breath of Technology."

As you point out, there will be a fairly small market for Mach 3 airliners. On the other hand, there will be a growing market for all other types, including medium-range jets in the Mach 1.5 speed-range category, and smaller turboprop aircraft vying for the enormous DC-3 replacement market.

Mention is often made in your columns that aircraft design must be principally evolutionary rather than revolutionary. I believe that to make the decision at this time to build a Mach 3 airliner will, for the British aircraft industry, be a revolutionary stride rather than an evolutionary one. When a Mach 3 airliner is built in the United States there will be behind it the practical experience gained in a large military aircraft, the B-70. It is unlikely that Britain will feel it necessary or economically wise to invest in the development of a Mach 3 bomber. Practical background experience, therefore, for the design and building of a British Mach 3 airliner will have to be drawn principally from Mach 2 fighters, only recently ordered into volume production. Surely Britain's current experience lends itself best to the design and manufacture of a Mach 1.5 medium-range airliner.

In terms of national prestige new aircraft have become instruments of propaganda. The British aircraft industry does not have unlimited funds. When Government financial support is given, it should go to projects where the British aircraft industry is best suited to compete and succeed. Britain should not feel that for reasons of national prestige it has to compete all across the board particularly where, as in the case of the Mach 3 airliner, the cost is so high (probably £300 million) and the reward so small (less than 100 production aircraft).

Tarrytown, N.Y. GEOFFREY R. SIMMONDS,
Simmonds Aerocessories Inc.

Beacon Power

IN your issue of April 3, page 471, there is a letter from Mr. A. James Bourne on "Beacon Power." Having read it, I feel I must express my envy for your good soil conductivity in Britain.

Apparently, with the figures given, the soil conductivity would amount to something in the neighbourhood of 10^{-13} e.m.u. (for a standard field strength at the edge of the service area of 70 μV/m).

Are the above figures valid also in the northern parts of Britain, where (it is said) the terrain is similar to that of Sweden?

Stockholm. BERTIL BRING.

The Cody Controversy

I DID not intend to write again about the "Cody controversy," but, on page 470 of your issue of April 3 Mr. Gibbs-Smith has again questioned the veracity of myself, Mr. Vivian Cody and others who saw Colonel S. F. Cody's first five flights on May 16, 1908. He states that we "did not know what this date was *until after 1948*." This I must flatly contradict (see below).

In the book *A History of Aeronautics*, by E. C. Vivian and Col. Lockwood Marsh—who was a member of the Gorell Committee—it is stated (p. 198) that "In connection with early flying in England, it is claimed that A. V. Roe, on 'Avro B' on June 8th, 1908, was actually the first man to leave the ground, this being at Brooklands, but in point of fact Cody antedated him."

This was written before October 1919, and the book was published by Collins in 1920. When Col. Lockwood Marsh was writing the book he borrowed the lantern slides Cody used in lecturing; lists of the slides, mostly in the pioneer's own handwriting, were pasted in the lids. One of these, in his writing, refers to "The first flight 16/5/08" (I produced this to a member of your staff in connection with my article published in *Flight* on May 16, 1958). Another slide—of the machine after it had collided with a water trough—clearly shows me standing nearby, and I have a copy of this photograph, which was taken by Vivian Cody. It clearly disproves Mr. Gibbs-Smith's assertion about "one witness" [Mr. Cody] "even denying the presence of the other," which latter I presume is myself. Vivian Cody denies that he said this, and I consider your contributor's statement calls for an apology to me.

An article in the *Aldershot News*, which gives a garbled account of an interview with Vivian Cody, published side by side with my own, has mixed up the first hour's flight with the May one, and was corrected by Mr. Cody the following week [our correspondent has enclosed the relevant cuttings for inspection.—ED.]. The broadcast (in celebration of the October 16 flight) was made on a tape recorder at Mr. Cody's house prior to the anniversary. References to the May flight were "cut" by the B.B.C., who at first said that the October flight took place on Salisbury Plain; this was corrected an hour later.

Regarding my first paragraph above may I point out that the scale model I made and gave the Science Museum in June 1948 bore a card stating that the machine made the first flights in England in May 1908? I hardly expected to live to celebrate the fiftieth anniversary of this, but I can easily prove the date. I saw Nazarro in a big Fiat racing car beat the record at Brooklands on Whit Monday, June 8, 1908, when for the first time a human being travelled at over two miles a minute, and naturally I have never forgotten it. I watched this from the signal box overlooking the track, and saw Roe's biplane near the finishing straight, but did not see it fly. Next day I was told by Signalman Matcham, in the presence of his son, that Roe had flown. I replied that Cody had flown three Saturdays previously. The son is still alive and confirms this, as do my surviving colleagues at Aldershot Station. The photograph of A. V. Roe on the track must have been taken during the winter of 1907 as there is snow on the ground and the trees are leafless, therefore it could not have been taken in June. Almost everyone glided down the slopes of hills in those days, but if one tried it with power, immediately the engine was opened up the machine would probably turn over on its nose. Roe wisely chose the level part.

Cody's tree originally bore the inscription that "Colonel S. F. Cody used this tree . . . from 1911 onwards." I drew Mr. Charles Gardner's attention to this, and also wrote to Maj. Oliver Stewart, who published my letter in *Aeronautics*. A new plaque was made and the tree fenced in. This gave the date of the first "officially recorded flight" as May 16, 1908, and the "first officially observed flight" as October 5, 1908. This was the first report Col. Capper made about Cody's flights and that is probably why it is so called.

The plaque was replaced by another in 1958 which states that Cody made *tests* in May 1908 and gives the date of the *first official flight* as October 16, 1908.

Virginia Water, Surrey. G. A. BROOMFIELD.

[Having seen a copy of the above letter, Mr. Gibbs-Smith comments: "Whilst not for a moment doubting the good faith of Mr. Broomfield and Mr. Vivian Cody in their own memories, I am unable to depart from my previously expressed statements about the S. F. Cody flights, as these statements were based on what I still consider to be irrefutable evidence. My full report on the Cody trials will soon be available for any serious student to consult."—ED.]

Second Argosy's Debut

A REGULAR reader of *Flight* for some years, I regard with satisfaction the consistently high standard of accuracy maintained; however, I detect a small error on page 489 of the issue of April 10.

The caption to the picture of the second A.W. Argosy states that the first public appearance of this particular aeroplane was on the 41st anniversary of the R.A.F., at Cottesmore. This is not the case. On March 21, at R.A.F. Station Lyneham, Wilts, this aeroplane, G-APRL, was demonstrated publicly on the occasion of an open day to mark the forthcoming introduction of the Britannia into R.A.F. service (a Britannia in R.A.F. markings was displayed statically).

I would echo the comment of your caption writer and say that finish and trim were favourably commented upon, adding that the spritely performance of the Argosy was most impressive.

Swindon, Wilts. J. M. DARWIN,
C/Obs., Royal Observer Corps.

FORTHCOMING EVENTS

May 8. Helicopter Association: "Helicopter Noise Suppression," by H. B. Irving.
May 8-10. Channel Isles Aero Club: Channel Isle Air Rally, St. Peter.
May 9. U.S.A.F. At Home: Wethersfield.
May 9-18. British National Gliding Championships, Lasham Gliding Centre, Hants.
May 14. R.Ae.S.: 47th Wilbur Wright Memorial Lecture, "Managing Aviation Technologies," by C. J. McCarthy.
May 16. U.S.A.F. At Homes: Bentwaters, Scuffthorpe and Alconbury.
May 16-18. International Sales Weekend: Cosnes-sur-Loire.
May 18. S.S.A.F.A. Display, Leeds-Bradford Airport, Yeadon.
May 21. Women's Engineering Society: "Aerial Survey Methods."
May 21-27. Institution of Electrical Engineers: International Convention on Transistors.
May 23-25. Quiberon Aero Club: Quiberon Rally.
May 24-31. Milon Aero Club: Rallie des Stars.
May 30-31. Dauphiné Aero Club: Grenoble Rally.
May 30-June 1. Air Sport Luxembourgeois: Rallie des Vins.
June 12-21. Paris Aero Show.
Sept. 7-13. S.B.A.C. Display and Exhibition, Farnborough.

R.Ae.S. Branch Fixtures (to May 15): *May 11, Glasgow*, "Philosophy of Gas Turbine Design" by A. L. Brown; *Halton*, "Some Aspects of Nuclear Propulsion," by S/L. G. R. Candy. *May 13, Chester*, a.g.m. and film show; *Southend*, "Space Travel," by Dr. G. S. Brosan.

It is now confirmed that Aerolineas Argentinas will replace their 16 DC-3s—some are seen here at Buenos Aires with one of the airline's D.H. Comet 4s—with Fairchild Friendships. A fleet of 10 is on order

AIR COMMERCE

RIGHTS OF A PILOT—1

FOUR feet and seven inches of the correspondence columns of *The Times* have, since April 21, been devoted to a debate on Britain's system of aircraft accident investigation. Among the contributors have been Sir Lionel Heald, Q.C., on behalf of Capt. W. H. Hankin [the Prestwick altimeter accident pilot]; Lord Douglas; Mr. D. Follows, of B.A.L.P.A.; Mr. Frederick Gough, M.P.; and Capt. C. C. Jackson, of I.F.A.L.P.A.

The controversy is on the matter of principle raised by Capt. W. H. Hankin's accident (*Flight*, April 3 and 24), particularly in respect of the rights of a pilot.

Sir Lionel referred to the need for a separate air accidents Board, independent of the M.T.C.A. air accident inspectorate (as recommended by the "highly qualified" Newton Committee in its 1948 report) to avoid the "embarrassing duality" of the Ministry, which (to quote the Minister himself) puts the safety of passengers first and justice to pilots second. Sir Lionel urged (1) an independent Air Accidents Board, representing the different interests of operators, aircrew, the Government, and the public respectively; (2) a public inquiry, with full protection for the rights of the pilot, where blame seemed attributable to him; and (3) deferment of disciplinary action pending results of the inquiry.

It was Sir Lionel's hint that (in so many words) B.E.A. were wrong to sack Capt. Hankin which drew a sharp rejoinder from Lord Douglas, who (again in so many words) said that an airline management must manage.

For the pilots Mr. Follows emphasized the long-felt need for independent investigations: "The Chief Inspector of Accidents is very largely both prosecutor and judge" in most accidents. Capt. Jackson said that the "private" Inspector's inquiry was the most objectionable aspect of the system. Public inquiries were fairer, but were they not too elaborate, too costly and too slow? A simpler system, public but not judicial, was needed to determine quickly the cause; so far as the rights of the individual (or organization) were concerned, procedures must be laid down for a legal hearing.

Mr. Gough spoke of the Minister's Herculean responsibilities, and the "prodigies of work" he had to perform "at sea, up in the clouds, off the rails, and in the soup." Was not a separate Ministry needed?

Perhaps Mr. Follows's suggestion was the best—the Minister should "look again at the recommendations of the 1948 Newton Committee."

RIGHTS OF A PILOT—2

LAST Wednesday, May 6, Mr. W. R. Williams (Lab., Openshaw) was to ask the Minister of Transport whether he would press for a reopening of the official German inquiry into the B.E.A. Elizabethan accident at Munich in February 1958. (The report was summarized in *Flight* of March 20.) The wife of Capt. James Thain, Mrs. Ruby Thain, who has a science degree, has put forward a theory to support her husband's contention that—contrary to the German investigation—ice formed on the wings *after* the crash. Her theory concerns the freezing properties of the fire-extinguisher chemical. This is how she explains it:—

"The snow falling on the fire-extinguisher powder would slowly melt. The diluted solution would then freeze at a temperature below zero. The temperature was actually minus 3 deg C. If there was a big concentration of the powder, it would freeze only at a lower temperature. This would explain what has so far been unexplained—why there was no ice behind the engine. Fire re-ignited there and it had to have a second dousing."

YEADON PLANS EXPANSION

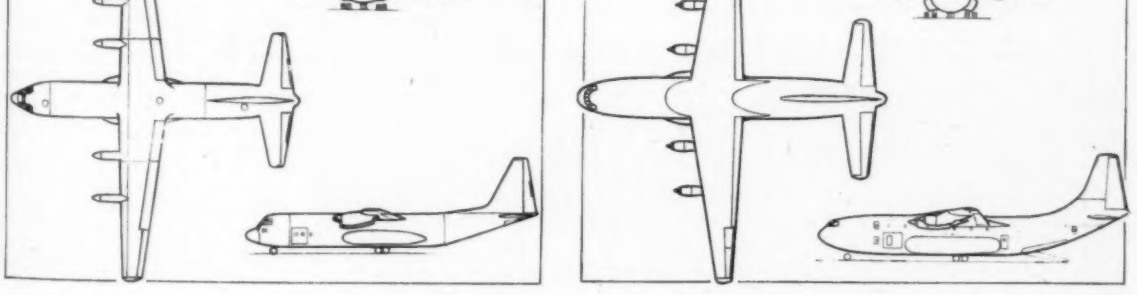
THE Leeds-Bradford Joint Airport Committee plan to spend between £1m and £1½m in extending and developing Yeadon as the airport for the West Riding of Yorkshire. Of this amount, about £250,000 will be spent on a new terminal building, which is sorely required even with the present peak summer traffic handled by B.K.S. and Silver City (Northern Division). Another £500,000 will be needed for runway extensions.

At present, Yeadon is unable to accept any aircraft larger than Dakotas, and this precludes the operation of Elizabethans, Friendships or Viscounts; but it is hoped to start work shortly on the extension of the present main runway from 4,000ft to 5,000ft, with proportionate extensions to the subsidiary runways.

In June the Joint Airport Committee will hold a meeting of all local authorities in the West Riding with a view to forming a consortium to finance and operate Yeadon. "If we can get the West Riding as a whole interested in flying from Yeadon," Alderman Frank O'Donnell (chairman of the Leeds-Bradford Joint Airport Committee) recently stated, "We shall be able to attract the present West Riding traffic from Manchester and interest such airlines as Aer Lingus."

At present Yeadon is linked to the Continent by B.K.S. to Basle, Düsseldorf, Ostend and Rotterdam and by Silver City to

Lockheed have announced a "Super Hercules" (C-130 development) for civil as well as military use, and for "early delivery." On the left is a general arrangement drawing, with another—to the same scale—of the Short Britannic 3 (also for civil as well as military service). Main change to the C-130 is that span is increased from 132ft 7in to 145ft and length from 97ft 9in to 121ft 1in. Engines are Allison T61; payload 70,000 lb (50,000 for non-stop Atlantic operation); and gross weight 204,170 lb. Operating cost is said to be "less than 3 cents per ton-mile." Details of the Britannic 3 (Rolls-Royce Tynes), which could be available in civil form by 1963-64, appeared in the February 20 issue



Britain's medium turboprop, the Vickers Vanguard (two off), at Wisley, Surrey . . .

AIR COMMERCE . . .

Brussels, and there are domestic services operated by the same companies to Belfast, the Isle of Man, Jersey and Newcastle. As the airport for an industrial area of about three million people, Yeadon would seem to have potential domestic, Continental and North American traffic. Services operated by British and European flag-carriers use Manchester as their North of England centre, and this entails a 50- to 120-mile surface-haul by the traveller from Yorkshire when joining his Continental or North Atlantic flight. A Leeds/Bradford - Dublin link, for example, connecting with the Irish Air Lines' North Atlantic service, would provide the Yorkshire textile executive with a means of reaching North America in under 20 hours' flying-time.

THE IRISH YEAR

DURING the financial year ended on March 31, Aer Lingus and Irish Air Lines (Aerlinte), carried a total of 515,355 passengers, 7,334 tons of freight and 1,743 tons of mail. Of this, Aer Lingus carried for the first time over half a million passengers on its domestic, United Kingdom and European routes—500,574 passengers, 7,227 tons of freight and 1,688 tons of mail were uplifted during the year.

Until the annual reports of the Irish air companies are published later this year, it is difficult to assess the commercial significance of these traffic returns in terms of airline economics. For Aer Lingus it was a year of consolidation and development of the new routes to the Continent inaugurated in 1957, with the addition of services to Rome via Manchester and Zürich, and via Lourdes. Both scheduled and charter flights to Lourdes during the Centenary Year of the Shrine carried very high load-factors, and, together with traffic to the World Fair in Brussels, contributed in large measure to the increase of 59,200 over the total of passengers carried in 1957-58.

Early in the year modifications to the Viscount 707 fleet necessitated a three-month lease of two Viscount 745Ds and a Viscount 800 to supplement the three Viscount 808s already operated. During the first quarter of the financial year two of the fleet of 12 DC-3s were sold and, towards the end of the year, a further five were offered for sale as the first of the seven Fokker Friendships ordered began to come into line service. The airline enters the new financial year—for which several developments of the European route pattern are scheduled—with a fleet of six Viscount 808s, seven Friendships and five DC-3s.

Delivery of Irish Air Lines' three Boeing 720-048s is to be made in late 1960 and early 1961, pending which the agreement with Seaboard and Western, due to expire in April 1960, will most likely be renewed.

SETBACK FOR EUROPAIR

THE sudden and, in the circumstances, dramatic withdrawal of K.L.M. from the "Europair" discussions came as a complete surprise. For Britons it was by no means an unpleasant surprise; indeed, some tentative sighs of relief may have been heard in Ministerial and Corporation circles.

Over the past four months we in Britain have watched with growing uneasiness the secret whisperings of the Common Market carriers—Air France (representing also U.A.T. and T.A.I.) Alitalia, K.L.M., Lufthansa, and Sabena. It has seemed that Europair would be detrimental to our interests, in ways suggested in *Flight* on February 27 and March 6. Of course, it had been obvious for years that Europe's airline industry was being retarded by nationalism. But suddenly five airlines, motivated by the spirit and ideals of the Common Market treaty, decided to make a real effort to sink their political differences. The outcome could have been—and might still be—a consortium of airlines of great weight and influence. The balance of European air power could have been—and might still be—heavily tipped away from Britain.

K.L.M.'s withdrawal was last week explained as follows:—

"The main differences between K.L.M. and the other four airlines lie in the manner of approach to the integration problem. The other airlines want to start the integration process by fixing the percentage of interest which each of the companies will have in a joint European company; but K.L.M. is of the opinion that this problem should be the last to be settled."

They would, the statement said, first like to work out agreements on:—

(1) The form of eventual joint operations. An important aspect of this would be the future of air transport in each airlines' own national territories, including those overseas.

(2) K.L.M. wanted a clearer insight into the sharing of expenditure and revenues.

(3) The "mutual aviation policies" should be more clearly outlined, and they considered of the utmost importance the form of authority of each airline.

(4) Detailed arrangements should be made for a transition period between now and the date when Europair could start operations—"which company will do what and for how long."

A K.L.M. spokesman would not speculate on the consequences of his airline's withdrawal from the talks. "Our withdrawal may only be temporary; the door is still open," he said.

A statement from the others said, in part:—

"As in previous meetings, the most important point of the discussions was the share each company has in the production of a future combined company. The participating companies have found to their great regret that K.L.M. at present is unable to take a final decision on this important point. The other companies are of the opinion that this problem is a point which has to be decided before everything else. K.L.M., however, is of the opinion that other problems should be studied first.

"Air France, Alitalia, Lufthansa and Sabena express their appreciation for the co-operation given by K.L.M. in drafting provisional plans and will continue their work to try and reach agreement . . ."

The meeting at The Hague, which was to have been chaired by Mr. F. Q. den Hollander, chairman of K.L.M., was the fourth in the series to date. Here is a brief history of "Europair" as far as it goes:—

Brussels, January 31 - February 2: Preliminary negotiations among the five airline chairmen.

Paris, February 27 - 28: Agreement on formation of an economic committee and a legal committee. Talks also about "Eurocontrol," to co-ordinate common market air traffic control services.

Rome, April 1 - 3: Continued discussions by the airlines' chairmen. Mr. Aler of K.L.M. spoke afterwards of "great progress," but said that no decisions had been taken. Main topic discussed was reported to be the percentage share of each airline in the total output of a "Europair." An official communique said that there had been "an extensive exchange of views concerning the principles of a close economic collaboration and the legal form of such collaboration."

The Hague, April 27: A meeting did not take place; it was cancelled when K.L.M. announced its withdrawal. Said Mr. Aler of K.L.M.: "Air France, Sabena, Lufthansa and Alitalia believe that something must be done at all costs, even if they don't know exactly what." Meanwhile, the remaining four agreed to continue discussions in Frankfurt on May 13.

What should Britain's reaction be to these significant developments? There is one positive thing we could do—revive the much-neglected, and slowly expiring, European Civil Aviation Conference. The E.C.A.C. was born in 1954 of precisely the same ideals which inspired Europair. As a branch of I.C.A.O. and the Council of Europe it was meant to knit together the air transport industry of Europe. Its recommendations have been numerous, but its resolutions few. Great things could come of it, as readers of Mr. Stephen Wheatcroft's book *The Economics of European Air Transport*, and his paper published in *Flight* for April 18, 1958, may recall. The machinery is there, and K.L.M.'s withdrawal from Europair provides a fortuitous opportunity for Britain to take the lead in making the real Europair—the E.C.A.C.—work.

J. M. R.

Footnote: Delegates from the airline pilots associations of the common market countries decided in Paris on April 30 to create a "European federation of airline pilots."

B.E.A.'S INSURANCE POLICY

LAST week it was reported that B.E.A. have decided to carry 50 per cent of their "hull" insurance risks, compared with 33⅓ per cent last year and 10 per cent the year before. This was confirmed by a spokesman.

The trend towards self-insurance by B.E.A., and by certain other airlines, is apparently the result of increased commercial insurance rates: underwriters in the London aircraft insurance world are said to have recently increased their rates by 2s in the £.

Last year B.E.A.'s hull insurance expenditure was nearly £350,000 on operating equipment and property valued at more than £16¼ million—a rate of about 2 per cent. This expenditure will certainly be substantially greater in the years ahead, when costly new Comet 4Bs and Vanguards are on the books, and at a higher rate per £ than ever before.

The new B.E.A. policy is applicable only to Viscounts, and not to Comets and Vanguards, which will be insured normally. The insurance world may well be cynical about the fact that B.E.A.'s total reserve for self-insurance is a mere £300,000, according to the 1957-58 balance sheet. But B.E.A. are apparently confident in the future of their new Comet 4Bs and Vanguards, and confident that they are justified in the gamble of increasing Viscount self-insurance at a time of transition to new and very costly airliners.

For the record, in March 1957, typical "formula" insurance rates for ground and flight risks to equipment (not including passenger liability) were as follows: S.B.A.C. method, 4 per cent of amount to be insured; B.E.A. method, 2.5 per cent; B.O.A.C. method, 3.5 per cent; ATA/Lockheed method, 5 per cent.

These rates show quite a large scatter—as do actual rates, which like any kind of insurance depend upon how good the risk is.

Reactions in the aviation insurance market to the principle of self-insurance (not particularly in respect of B.E.A.) might be summarized as: "They'll come back."

. . . America's medium turboprop, the Lockheed Electra (on delivery to Ansett-A.N.A. in Australia), seen at Fiji . . .

SHORT LIGHT AIRCRAFT

IN a brief announcement last week Short Bros. and Harland stated that the company had formed a Light Aircraft Division to develop a general-purpose transport as a private venture. Preliminary design of the new aircraft, which is known as the S.C.7, has been completed. Shorts say that it will carry a payload of 1½ tons and will be capable of operating from small airfields, both as a passenger transport and as a carrier of all types of freight, including motor cars.

No technical details have yet been given for the S.C.7 nor has the powerplant been announced. The payload is of the same order as that carried by the Twin Pioneer and the aircraft will apparently fulfil a similar function to that intended for the Miles HDM.106. This announcement appears to be a fulfilment of recent hints by Mr. Peter Masefield that a major aircraft company would soon be entering the light aircraft field.

Shorts are thus now constructing the largest and smallest British transport aircraft—the S.C.7. and the S.C.5 Britannic (see also page 649).

. . . and Russia's medium turboprop, Aeroflot's Ilyushin Il-18 Moscow, seen at the Black Sea resort of Adler on its inaugural passenger service from Moscow on April 20

CUNARD SAILS INTO SUBSIDY

PUBLICATION of the Cunard annual report is a reminder to the airlines that, for the first time in the history of British shipping, a government subsidy is being sought for the construction of new liners to replace the 23-year-old *Queen Mary* and 19-year-old *Queen Elizabeth*. Although North Atlantic traffic has swung in favour of aircraft as parity in fares is approached (of the 69 per cent increase in passengers carried since 1952, air passengers have increased by 176 per cent, sea passengers by 14 per cent) Cunard still hold pride of place among the Atlantic shipping lines; last year, when sea traffic declined, they managed to increase their lead. But competition is mounting; B.O.A.C. first-class bookings between London and New York, for example, have increased by 100 per cent (a measure of the appeal of the Comet) and economy-class bookings are up by 30 per cent on last year. Cunard are also faced with heavy opposition on the sea, much of it state-assisted. Soon to be in competition with the Dutch *Statendam* and *Rotterdam* (£2.5m out of the £12.5m required to build the latter has been lent by the Dutch government), the *France* (carrying a £7m subsidy on constructional costs of £32m), the sister ship to the *United States* (£30m out of £46m subsidized) and new liners from Italy, Canada, Germany and Greece, Cunard must decide on what type of vessels are needed to replace the Queens. Each of these big liners has a displacement of more than 80,000 tons and carries over 2,000 passengers; but now such great capacity may no longer be required. The mass-travel market for which the Queens were built is passing to the airlines and the economy fares that these may soon be able to offer may be out of the competitive reach of shipping companies.

About £50m would be required to replace the two Queens and some £20m of it may have to be public money. If Cunard is to uphold British prestige on the North Atlantic—and its own competitive position—decisions must soon be made not only on the size of liner but on the standard of accommodation that would be offered. One suggestion is that, while still maintaining a small first class, the company might try to attract traffic by offering "five-day cruise" standards of comfort for tourist class passengers, thus steering a middle course between de luxe and economy classes offered in the air.

F.I.R. FURORE

POLITICAL squabbles between France and Tunisia are leading to disputes and confusion over the boundaries of the Flight Information Regions in North Africa. A large prohibited area, introduced by the French along the North African coast in 1956 as part of their military efforts against Algerian rebels, formed the basis of the Tunis F.I.R. when that country—along with Algeria and territories to the south—was under French control, and for administrative reasons the Tunis F.I.R. was drawn as a set of straight lines with the verticals running North and South. As such, it was incorporated in the I.C.A.O. plan for Europe and Africa.

When the French withdrew from Tunisia, they handed over civil aviation in the area to Tunisian control and realigned the F.I.R. boundaries with the national frontiers, and in doing so reduced the area covered by the Tunis F.I.R.. This action is disputed by Tunisia, which insists that the old boundaries—according to the I.C.A.O. plan—still stand.

French efforts to control air traffic coming in from the east along the N. African coast line are consequently being severely hampered. Whatever theoretical arguments can be advanced for the Tunisian attitude, it must be galling for the French to have an ex-territory laying claim to airspace that is really French.

A result of this dispute is that since August last year aircraft crossing the Tunis-Algeria boundary on the north-south ADR 256 and on ADR 452 from Tripoli, do not know to whom to report at the southern end of the F.I.R. And when Malta F.I.C. release an aircraft from the south-west corner of their region they do not know whether they are sending it into the Algiers or Tunis F.I.R. —the aircraft captains have to try and pacify each centre by reporting to both at the appropriate reporting point. The result is chaos and, so far, the good offices of I.C.A.O.'s regional office in Paris in settling the dispute have been rejected.

AIR COMMERCE . . .

ANOTHER DC-8 CUTBACK

IN their annual report for 1958 Eastern Air Lines disclosed that they have cut back their order for DC-8s from 20 to 16, as a result of "re-evaluation of needs." The airline's opinion on a further six DC-8s still stands. The report adds that DC-8 deliveries will be in the autumn of this year, and that training will be completed in time to operate the first scheduled services in the 1959-60 winter season. (First DC-8 delivery, for training, will be to United Air Lines next month—on schedule.)

Eastern are the third airline to reduce an order for DC-8s. National Airlines originally had six on order, and reduced this number to three (*Flight*, October 17, 1958). Again, Delta originally had eight DC-8s on order, but reduced this number to six (*Flight*, same issue).

These cancellations represent a loss to Douglas of about £20 million worth of business. It is of no comfort to the American firm that "re-evaluation of needs" had been prophesied (among others by Dr. Cherington) as inevitable in an over-mortgaged airline industry; that it should be the DC-8 order book that has been so heavily chopped is no doubt just coincidence.

The balance of the DC-8 order book has been somewhat restored by a Philippine Air Lines order for two at a cost of £5¼m, for delivery in late 1960. With these aircraft P.A.L. will re-introduce the international services discontinued a few years ago.

Blueair is the name under which some aircraft of Independent Air Travel are now operating. The fleet comprises five Vikings, one of which is seen here, three DC-4s, and a Beechcraft

BREVITIES

Iberia lost a DC-3, EC-ABC, on a flight from Barcelona to Madrid in a storm on April 30. None of those on board—25 passengers and three crew—survived.

* * *

It is expected that B.O.A.C. will now go through with plans to declare 1,095 workers redundant at its London Airport engineering base. The unions are reported to be resisting strongly.

* * *

Mr. E. R. Quesada, head of the American F.A.A., had "an exchange of views" with the M.T.C.A. on April 29. He lunched with the Minister and on the next day visited the A.T.C. Experimental Unit and Southern A.T.C. Centre, London Airport, and the Blind Landing Experimental Unit at Bedford.

* * *

Last Monday the Mayor of Luton, at a ceremony at Luton Airport, inaugurated work on the construction of the first concrete runway. Measuring 5,400ft by 150ft, it will cost £300,000 plus a further £25,000 for approach and runway lighting. The runway will be completed within seven months, and the whole programme within a year.

* * *

Canadian history was made on May 4 when C.P.A.L. inaugurated the first competitive domestic trunk route services—using Bristol Britannia 314s—between Vancouver, Winnipeg, Toronto and Montreal. Frequency will be one flight per day each way and the Britannias will have seating for 38 first-class and 51 tourist-class passengers.

* * *

The latest Port of New York Authority analysis of jet operations from N.Y. International Airport notes that B.O.A.C.'s de Havilland Comet 4s observed the correct noise reduction procedures on 143 of 148 take-offs during the first six months of service. The Corporation was complimented "for creating the least noise nuisance of any airline." See also *Flight* for April 10.

* * *

A contract has been signed by Aerolineas Argentinas and B.O.A.C. by which the latter will be handling the maintenance of the Comet 4s of Aerolíneas in London, Frankfurt, Rome and New York. This is the first contract of the kind between these two carriers, and it is to be "the first step leading up to closer co-operation between them on a wider range." Contrary to recent reports, B.O.A.C. have no *commercial* arrangement with Aerolíneas with regard to Comet 4 services by each airline across the South Atlantic between London and Buenos Aires. The Argentinian airline will start these services this month; B.O.A.C.'s services will not begin (as recently announced in Parliament) until next spring.

* * *

A surprise announcement from Hawaiian Airlines last week said that the company had deferred "the earlier announced plan" to convert Convair 340s to turboprop power.

* * *

Mr. Donald W. Douglas Jr. has referred to airline interest in a cargo version of the DC-8 with JT3 turbofans. It is likely that this version would have a swing tail.

* * *

We are asked by Capt. M. K. Kozubski, managing director of Falcon Airways Ltd., to state that, contrary to a previous report in these columns, Falcon Airways Ltd. is in no way connected with Independent Air Travel Ltd.

* * *

The gross weight of the D.H. Caribou has gone up from 24,000 lb to 26,000 lb. The fuselage has been lengthened by 45in to 28ft 9in, increasing the volumetric cabin capacity and floor area. Accommodation for up to 40 passengers is now possible.

* * *

An Aeroflot Tu-104 arrived at London Airport last Monday on a proving flight prior to the inauguration of B.E.A.-Aeroflot services next week. On board were a party of 20 Aeroflot executives and 12 crew-members, who were to remain in the U.K. under training for a few days.

* * *

The automatic pilot system in the Vickers VC.10 will be of the Bendix P.B.20 type, manufactured in close design co-operation with Vickers by the Aviation Division of Elliott Brothers of London. The system will comprise a fully integrated dual autopilot, flight director and polar path compass. Designation is E.B.20. The initial order is valued at nearly £2m.

* * *

The front cover of the 1958 annual report of Okanagan Helicopters Ltd. is a colour picture of the Fairey Rotodyne, of which the chairman, Mr. L. F. Stevenson, says in the report: "The development by the Fairey Aviation Company Ltd. of the Rotodyne for inter-city airline service has been closely watched by management with the result that an order has been placed for one of these aircraft with an option for an additional two. In preparation for this service your management is proceeding with an application for a licence to operate Rotodyne between Vancouver, Victoria and Seattle."

HANDLING THE TIPSY NIPPER (Continued from page 635)

(about 3,200ft) to try some aerobatics. A barrel roll at 150 km/hr proved a wee bit disappointing, but a slow roll was satisfying, with plenty of rudder control available. Care was required to maintain direction. The loop was really a controlled throw, starting at something over 150 km/hr and using all available power as speed fell off very rapidly. Rather slower starting speed, tried later, allowed more power to be applied sooner and produced a quicker loop. I hit my own slipstream with the first loop. Stall turns at progressively steeper angles showed a tendency to emerge in a normal turn. The main lesson is that Nipper aerobatics are on a minute scale and must be performed with this in mind. The machine must be flown precisely to obtain exact results, but there is fighter-like control and, surprisingly, a mere 40 h.p. is ample. From the ground, Nipper aerobatics look like the twizzling of a household fly.

Approach for landing was at 85 km/hr. Rate of sink increases noticeably with any reduction in speed and a steep approach is possible. After the briefest round-out the Nipper can be thrown into the grass. It rocks on to its nosewheel instantly, clatters along for a few seconds, and stops. Directional control is complete and brutal brake can be applied. Almost immediately after touchdown it could be driven away to the hangar at full tilt. I had great fun belting round a stately Chipmunk twice my size. The pilot in his yellow bone-dome looked down his nose.

Two more circuits confirmed the jump-take-off tendency, but I almost completely damped it out the third time by resting my forearm on my knee. Both the other landings were just where I wanted, after steep approaches and with ridiculously short landing runs. I'll fly a Nipper again any time, anywhere—the sooner the better.

B.E.A. ROUND THE WORLD

BY A. H. MILWARD

Chief Executive, B.E.A.

PART I

THE title of this article is not meant to suggest that B.E.A. are following B.O.A.C.'s vapour trails in a round-the-world service: it is merely an informal account by the Corporation's chief executive of a 30,000-mile trip earlier this year during which the author visited B.E.A.'s potential ticket-selling markets overseas. It was written primarily for B.E.A.'s staff, and appears (virtually as produced here) in the "B.E.A. Magazine."

I THOUGHT it might be of general interest if I tried to put down on paper a brief account of my tour of Canada and Australia, though I would like to emphasize that spending 26 days on a 30,000 mile trip leaves one only with a very general view of the world's airlines. Anyone who is looking for a detailed technical assessment of operations in other parts of the world will, I fear, be disappointed.

From B.E.A.'s point of view it is significant that 29,800 of these miles were flown literally without incident and almost entirely on time. The last 200 miles were completed in a B.E.A. Viscount which operated into Gatwick under marginal conditions. The journey from Gatwick to my home, by car, took three and a half hours. This leaves me with the impression that we in B.E.A. are doing the most difficult airline feat in the world, operating an intensive series of services with a tight integration of aircraft and crews in a part of the world which is notorious for its bad weather.

Later on I shall be referring to my flying in Canada at sub-zero ground temperature, but nothing I found there equalled the difficulty under which our crews operate.

London/Prestwick/Montreal by B.O.A.C. DC-7C. An uneventful flight. It was noticeable that a fair proportion of the load was taken on at Prestwick. As usual the B.O.A.C. cabin service was excellent.

I found that my four days in Montreal were heavily occupied in what might be called "sales promotion." Gerry Wynne, public relations officer of B.O.A.C., had arranged a lot of Press interviews and a lunch in order to launch our new sales manager for Canada, Alan Mills.

There is an enormous public interest throughout Canada, and for that matter throughout the world, in the affairs of B.E.A. Our market in this great continent is, in my view, scarcely tapped as yet, though we have set ourselves a target of some seven million dollars of revenue in the coming financial year.

I flew some thousands of miles by T.C.A. Viscount. Canada was in the grip of a particularly cold spell, with temperatures down to minus 20°F (52° frost) and there had also been recent falls of snow. At no time on my flights was I delayed in any way by weather conditions, and although one cannot judge by one week, I formed the conclusion that weather—intensely cold though it is in Canada—does not present the difficulties we experience in B.E.A. On flights to Toronto and back, and across the continent to Calgary, T.C.A.'s Viscount timekeeping was literally perfect on every take-off and landing. Both operating staff and crews expressed the greatest confidence in this aircraft and in cold weather they considered them unequalled, engine starting for instance being practically unaffected by the temperature.

T.C.A. Viscounts are being fitted with weather radar, as indeed are those in T.A.A., and it is significant that every Captain to whom I spoke on the whole of my world flights swears by weather radar as a means of avoiding damage to aircraft and discomfort to passengers and crew. B.O.A.C., in addition, set great store by this equipment for navigation purposes, and it is certainly fascinating to see one of the Pacific islands painted on the weather radar so that the shape corresponds precisely with the map in one's hand.

Our old controversy on the use of chocks was, of course, in my mind. It is significant that T.C.A. have never employed chocks with their Viscounts; in fact, they appear almost to have forgotten their existence.

Chocks are not even used in winter on snow or ice covered aprons, and brake failures do not seem to occur. In Australia, by contrast, nose-wheel chocks are still used by T.A.A. for no other reason than that they had once damaged an aircraft when it rolled down a slope!

I was very interested in T.C.A.'s method of cabin heating which, on their stopping services across Canada, is very necessary, passengers being allowed to remain on board during transit stops. Immediately the aircraft arrives at a station a power supply is attached and the captain starts up a paraffin heater which is part of the permanent equipment of the aircraft, the cabin blower distributing the heat.

Vancouver/Sydney by C.P.A.L. DC-6B. This flight was the only one appreciably off-schedule on my complete tour. The aircraft left 3½ hours late through waiting for connecting passengers and awkward freight loading (just like B.E.A.!). Time was lost on the way through head-winds but the flight was extremely well conducted, the first class service and food leaving nothing to be desired.

One has to fly over the Pacific to realize the size of this ocean. In a DC-6B it is a solid 32 hours flying from Vancouver to Sydney and one certainly notices it. It takes 12 hours from Vancouver to Honolulu, 12½ hours from there to Fiji (I believe that this 3,200 miles is the longest ocean flight in the world), and a further eight hours from Fiji to Sydney.

It is interesting to observe how these flights are operated and the contrast with B.E.A.'s system is sharp. The captain told me that there can be no real alternatives on the route because of the distances involved and the absence of landing places in the Pacific. Reliance on good weather is absolute and enough fuel is held for a modest stand-off in the event of temporary rain storms over the Hawaiian Islands. In contrast to our air traffic control problem, it was interesting to hear the captain say, shortly after leaving Honolulu, that he did not think there was another aircraft in the sky between that point and Fiji, a distance of some 3,000 miles.

We arrived at Mascot Airport, Sydney, three-quarters of an hour early after an extremely well conducted flight, to find the depressing dump which is their main airport.

Australia. The next eleven days were spent in Australia, a country which I had wished to visit for many years but which I instinctively expected to dislike. I find, talking to friends in this country, that many of them have the same ideas of Australia and I can only think that this is because of the poor publicity in which that great country indulges in the United Kingdom, a point I made to the Head of the Commonwealth Society whom I met in Sydney. In point of fact my wife and I both enjoyed our stay in Australia immensely. Australians are kind, hospitable and extremely Commonwealth-minded and we received a welcome of which it would be impossible to speak too highly.

Considering that Pat O'Shea and his wife have only been in Australia for 18 months B.E.A. is surprisingly well known, respected and admired there, a point I attribute to some extent to the part we played in introducing the Viscounts into T.A.A. service some five years ago and the subsequent help we have given in getting them well established.

It has to be remembered that Australian airlines benefit from two great gifts to aviation, a remarkably poor train service with frequent changes of gauge, and weather conditions which are probably the finest in the world. Once again, at no time did weather enter into our calculations at all so that "weather stand-bys" never have to be considered.

(To be continued)

Typifying B.E.A.'s approach to sales—the primary purpose of Mr. Milward's trip—is this handsome new sales office in London, at 102 Cheapside E.C.2. It will serve the City's growing need for air travel

The Industry

de Havilland Chairmanship Changes

Mr. W. E. Nixon (left) and his successor as chairman, Sir Aubrey Burke

AS briefly recorded in the main news-pages of this issue, the most senior Board appointments within the de Havilland organization are to change hands on June 30, when Mr. W. E. Nixon, F.C.I.S., retires and Sir Aubrey Burke, O.B.E., succeeds him.

Mr. Nixon retires from the chairmanship and managing directorship of de Havilland Holdings Ltd.; from the chairmanship of the de Havilland Aircraft Co. Ltd., de Havilland Propellers Ltd. and the Aircraft Manufacturing Co. Ltd.; and from his directorships of the de Havilland Engine Co. Ltd., de Havilland Aircraft of Canada Ltd., de Havilland Aircraft Pty. Ltd. (Australia), the de Havilland Aircraft Co. of South Africa (Pty.) Ltd. and the de Havilland Aircraft Co. of New Zealand Ltd.

Sir Aubrey Burke, who is at present deputy chairman of the holding company, deputy chairman and managing director of the aircraft company, chairman of the engine company, a director of de Havilland Aircraft Inc. and managing director of the Aircraft Manufacturing Co. Ltd. is to succeed Mr. Nixon in each of the appointments named above.

Wilfred Nixon's first connections with aviation were in 1910, when he went to the Balloon Factory at Farnborough (forerunner of the R.A.E.), where he met Geoffrey (now Sir Geoffrey) de Havilland. Towards the end of World War I he renewed the association, joining Capt. de Havilland at the Aircraft Mfg. Co. Ltd. at Hendon. In 1920, with other colleagues of subsequent years—Messrs. Walker, Hearle and St. Barbe—he helped to found the de Havilland Aircraft Co. Ltd. Since then, for nearly 40 years, he has been responsible for financial policy and many other matters.

Initially company secretary, Mr. Nixon was appointed to the Board in 1931 and succeeded Mr. F. T. Hearle as managing director in 1944. In 1954, when deputy chairman, he succeeded Mr. Hearle to the chairmanship. A year later he relinquished the managing directorship of the aircraft company to Mr. (now Sir Aubrey) Burke, but became head of the newly formed holding company.

Of Mr. Nixon a colleague has written: "He is universally thought of as a warm-hearted and genial individual, an orderly and unhurried administrator, a fair and kindly man, a patient listener; but his light touch and easy manner have never misled us as to the firmness of his grip on a matter that is under discussion or the thoroughness which he will apply in dealing with it."

Mr. Nixon's judgment played a large part in many weighty decisions made by the company through the years. These included, to quote a few only, the advisability of entering the engine field of manufacturing v.p. propellers, of building jet airliners, and of leasing the Chester factory in order to fulfill large Vampire and Venom orders without interfering with Comet production.

Sir Aubrey Burke's association with the D.H. enterprise is a shorter one—he joined it in 1944—but he had previously had long and varied experience in aviation. In the early 1930s he was with Vickers on rigid-airship construction; then, after taking the A, B, C and D ground engineer's licences—at one period he was the only man to hold all four—he joined Ford and assisted in European demonstrations of the Trimotor. Next, after two years with Airwork, he entered Imperial Airways, and on the formation of B.O.A.C. in 1939 became superintendent of technical development.

In the early war years he was at the Ministry of Aircraft Production, where he carried a large share of responsibility for the Civilian Repair Organization; he was also for a time deputy managing director of D. Napier and Son. Rejoining B.O.A.C. in 1943 he became their assistant director-general (technical); then, less than two years later, he went to de Havilland as director and general manager of the newly formed engine company, becoming its managing director in November 1948 and its chairman—in succession to the late Maj. F. B. Halford—in 1955. Various directorships within the wider de Havilland organization followed, and on January 1, 1956, he became managing director of the aircraft company; three years later he was knighted. He was appointed deputy chairman in 1956, and a year later was elected to a similar position in the holding company.

Sir Aubrey, who is a member of the A.R.B., is the 1958-59 president of the S.B.A.C.

Tape-recording Aircraft Behaviour

A NEW flight recorder has been produced by Royston Instruments Ltd., of Chertsey, Surrey, for commercial aircraft. Based on automatic tape recorders produced for test and development flying and industrial applications during past years, the new equipment has been prepared to conform with the airline specification issued by the European Airline Electronic Committee last year. Any kind of performance, functional and positional information, reduced to electrical voltages, can be recorded on seven information channels, using time multiplexing to sense from 700 to 70,000 points per second on up to 300 channels on a single length of tape which would cover 150 hours' aircraft operation. The complete recording equipment is designed for A.T.R. racking, would weigh 40 lb, measure 10in × 19½in × 7½in, and would cost about £2,000 per unit. An eighth signal channel would carry a timing signal and aircraft identification, date and flight number.

Playback equipment, with accelerated reproduction, has also been prepared; additionally, the tape may be initially sampled on simplified local equipment or re-recorded for simultaneous inspection at different places. In the event of an accident the tape cassette can be ejected from the aircraft by an explosive charge initiated either by a pilot-operated switch or by an inertia switch. The recorder would automatically work whenever the aircraft master switch was on. A float, a dye marker and a radio beacon would help to recover the tape record after an accident.

It would be possible to record comprehensive information on the functioning of each engine, control-surface positions, flight parameters and many other factors which could then be used after routine flying to analyse the wear on each part of the aircraft. In this way it might be possible to make an exact assessment of overhaul requirements based on actual wear rather than on arbitrary and conservative estimates which must at present be used.

A British airline has shown considerable interest in the recorder and flight trials are expected to begin in June or July. The Royston equipment appears to be more comprehensive than the other flight recorders so far produced.

Being loaded into a Bristol Freighter sent from Sweden to Southend Airport are components of the Solartron ten-target radar simulator recently ordered for the Royal Swedish Air Force. The equipment was despatched in two loads, on April 23 and 29

IN BRIEF

Mr. G. C. D'Arcy Biss has been appointed an additional director of the Fairey Co. Ltd. He is a senior partner in the firm of Ashurst, Morris, Crisp and Co., who have been solicitors to the company since its foundation in 1915.

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Mr. R. S. Hewitt has joined the Board of Elliott Brothers (London) Ltd. He started his career with Elliott Brothers in 1928 and is deputy controller of Elliott-Automation.

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Col. A. E. Tyler, O.B.E., has been appointed managing director of W. S. Electronics (Production) Ltd., which is a wholly owned subsidiary of K.G. (Holdings) Ltd.

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Rotol Ltd. (who, incidentally, were showing a representative range of their products at the recent Hanover aircraft exhibition) were hosts at their Gloucester headquarters on April 24 to 24 members of the S.B.A.C. education and training panel.